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## The Electric Systems of the North and West Chicago Street Railroad Companies.

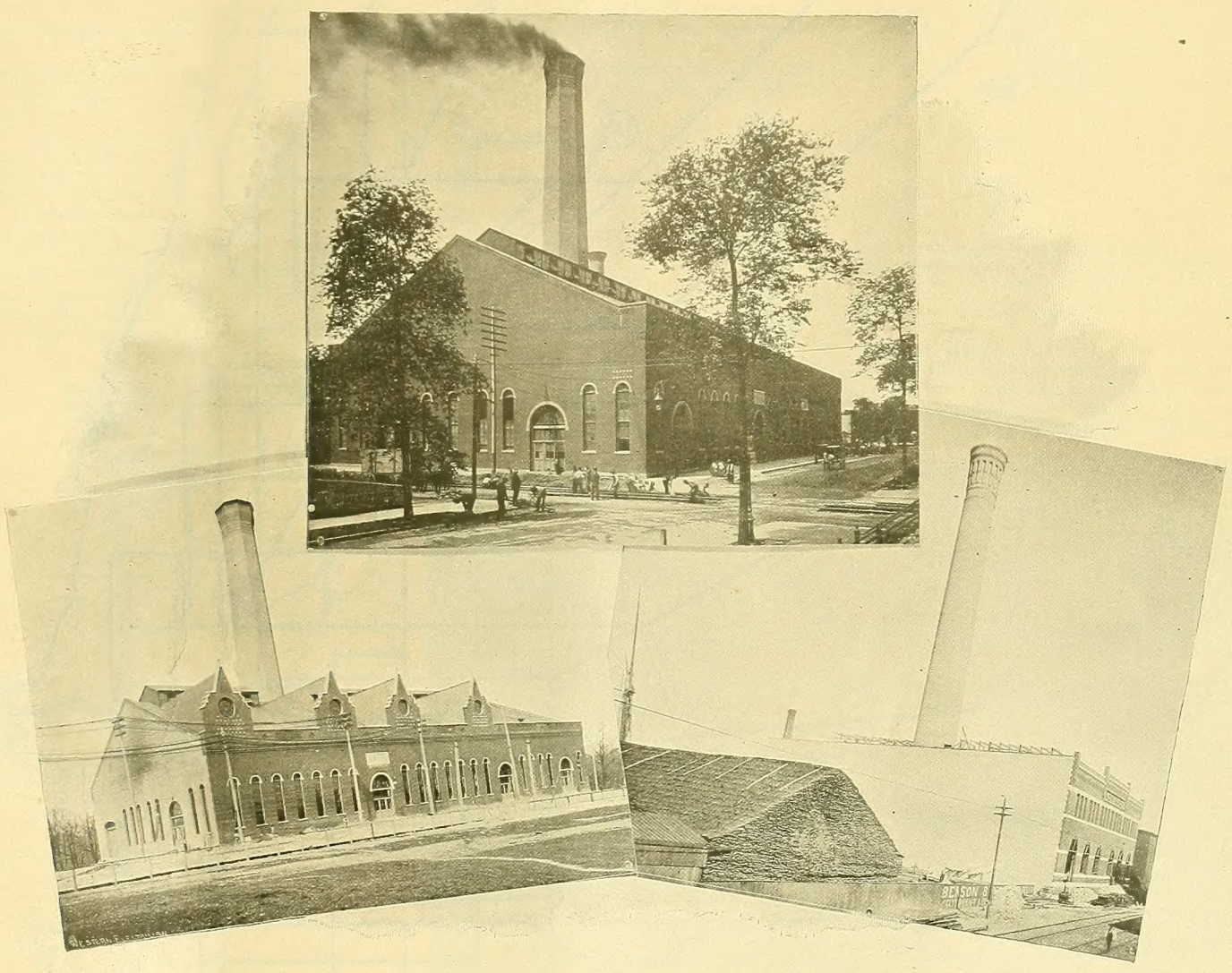
By Edward M. Hagar, S. B., M. M. E.

I.—INTRODUCTORY.

While Chicago is the latest of the large cities of the country to make a comprehensive movement to substitute electricity for horses as a motive power for its street cars, when the decision was reached that the change must be made no time was lost in accomplishing it.

An ordinance was passed in April, 1894, granting to the North and West Chicago Street Railroad companies, or the one office, that of the Electrical Department of the North and West Chicago Street Railroad companies, under the management of James R. Chapman.

The map on the next page, Fig. 2, gives an idea of the extent—so little appreciated by the general public—of this great network of electric railways. All the solid black lines are electric roads, many now in operation and the remainder in process of completion, and the total of 210 miles will doubtless be open by the first of September, within sixteen months from the beginning of the work. The mileage of cable lines, shown dotted on the map, is insignificant in comparison with that of the electric lines.



California Avenue. Western Avenue. Hawthorne Avenue.

FIG. 1. THE ELECTRIC SYSTEMS OF THE NORTH AND WEST CHICAGO STREET RAILROAD COMPANIES.—THE THREE POWER HOUSES.

"Yerkes system," as it is commonly known, permission to equip their horse car lines electrically. The idea was, at first, to have generating plants in the largest cable barns of the North Chicago company, but this idea was abandoned when a conception was had of the size of the work in hand, and now there are three immense power houses, shown in Fig. 1, with an aggregate ultimate capacity of 20,000 indicated horse power and 15,200 kilowatts electrical output. One of these, now in operation, is the power house of the Chicago Electric Transit company, a corporation under the same control as the two above named companies and which, together with several other subsidiary companies, is to be taken as a part of the one immense system under consideration.

All the work of transforming the old horse car lines and constructing new electric lines has been accomplished from

Great improvement has been made very recently in the design and construction of the equipment and machinery for electric roads, as generators, motors, line material, etc., through the experience gained by the conversion to electricity in the other large cities, and, for that reason, these companies have secured a construction probably more modern and efficient than any other existing system, and at the same time have provided it at the least cost, as prices have fallen greatly in the last two years. At the time when most of the purchasing for the construction work was done the prices of copper and other material and apparatus were at the lowest point, and these prices have since risen materially, copper in particular having advanced 25 per cent. So the tardiness in adopting electricity has resulted beneficially in giving better quality of apparatus at a lower cost. As at present small improvements are being made, these roads will stand as models of up-to-date electric railway construction for some time to come.

II.—TRACK CONSTRUCTION.

A uniform standard of heavy girder rail construction is used throughout, and all the old horse car rails were taken up, even some new girder rail of fairly heavy weight.

The new track is laid with seven-inch Johnson side bearing girder rail in 30 and 32 foot lengths, weighing 85 pounds to the yard. The rails are laid with tight joints in fish plates 26 inches long, weighing 30 pounds each, and bolted with six one-inch bolts, resting on a plain plate on the ties. Brace tie-plates are placed on alternate ties with four spikes, four inches long and seven-sixteenths inch section, with a special head, allowing of redrawing.

The ties used are of sawed oak five inches by eight inches and seven feet long, spaced 24 inches, except under the joints, where they are closed up. Ties are laid in gravel, and in some streets broken rock was used for tamping. The special work and car-house entrance curves are of nine-inch rolled steel girder rail with guard rails weighing 117 pounds per yard.

At railroad intersections the Johnson crossings, with grooved rail heads on both steam and street car rails, are used. The switches and special work are of the Johnson "guarantee special work," using hardened steel plate for the points of greatest wear.

Fig. 3 (page 3) shows a reproduction of a photograph of

the car-house entrance curves from a supplementary track at the Western avenue barns, at the corner of Washington boulevard. The work is shown during construction, with three of the nine curves completed.

The track work for these roads was done by the American Railway Construction company, and some very intricate and difficult work was encountered at points where very many lines converged.

The track is bonded at each joint with two 36 inch No. 0 "Chicago" rail bonds. This rail bond is well known and needs no description. The rails are cross bonded every 500 feet, and a tap from the rails is taken under the pavement to the tap pole, which occurs every 1,000 feet. All exposed copper is asphalted. The cost of bonding one mile of double track was found to be practically $300.

III.—ELECTRICAL CONSTRUCTION.

*Overhead Work.*—The construction of the overhead line work shows that advantage has been taken of the experience in this direction of other roads already built, and is probably as reliable and durable as is possible to make it, and very little improvement can be looked for in the future in this direction.

The street to be equipped electrically is first surveyed and marks made on the curb for the pole locations. The poles, by the city's requirements, are on an average 115 feet apart, set in the gutter and preferably located on the property lines of lots. A plat is then made of the pole lay-out, which is submitted to the city authorities for approval, and a permit is granted to set the poles as platted.

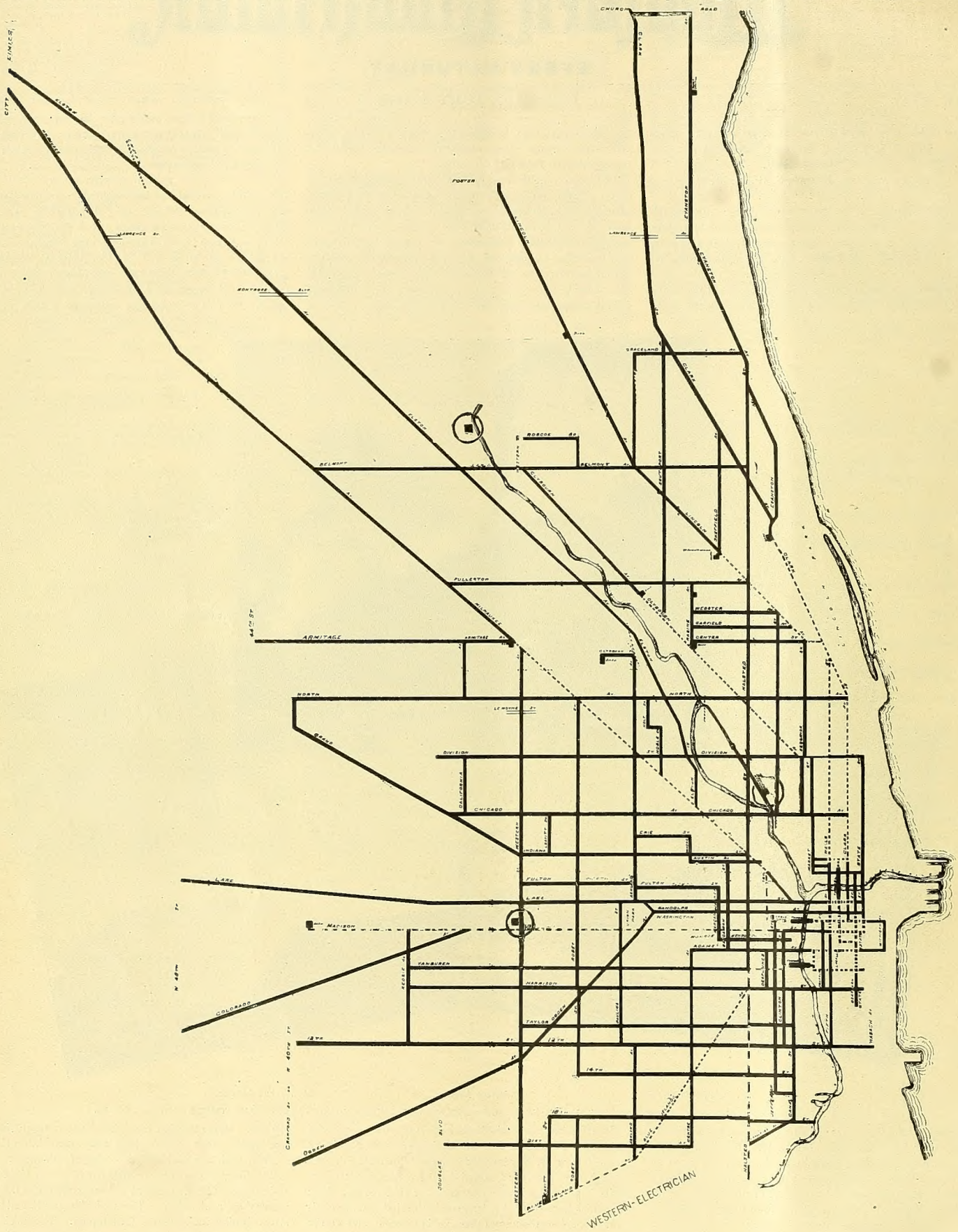



FIG. 2. THE ELECTRIC SYSTEMS OF THE NORTH AND WEST CHICAGO STREET RAILROAD COMPANIES.—MAP OF ELECTRIC AND CABLE RAILWAYS.

The poles used are of iron, except those for some feeder lines on unimproved streets, where wooden poles with double cross-arms are used. Side pole construction is used throughout, except for a few extra wide streets, where center poles were advisable, and for boulevards, where the bracket pole is least objectionable.

Figs. 4 and 5 show the standard side pole construction

with guard wires and the ornamental bracket pole. Fig. 6 (page 7) illustrates the center pole with the hanger placed on a short span wire, which gives the desired flexibility.

The poles were supplied by the National Tube Works of Chicago and Morris, Tasker & Co. of Philadelphia, and are made up of three sections of extra heavy wrought-iron pipe with swedged telescopic joints. The sections of poles are of seven, six and five inches inside diameter, in lengths of 30, 31½ and 33 feet, and of eight, seven and six-inch sections in 30, 31½, 33 and 34½ foot lengths. The weights of these poles vary from 915 pounds for the 30 foot pole, with seven, six and five-inch sections, to 1,500 pounds for the eight, seven and six-inch sections, 34½ feet long. The heavier poles are used at terminals, for pull-off poles at curves and at turns in the feeder lines. The longer poles are for railroad crossings and for carrying the feeders, and for the latter use their height depends on the number of cross-arms necessary for the feeders to be carried. These poles are set in six feet of concrete and are protected from rusting caused by the street liquors, by a

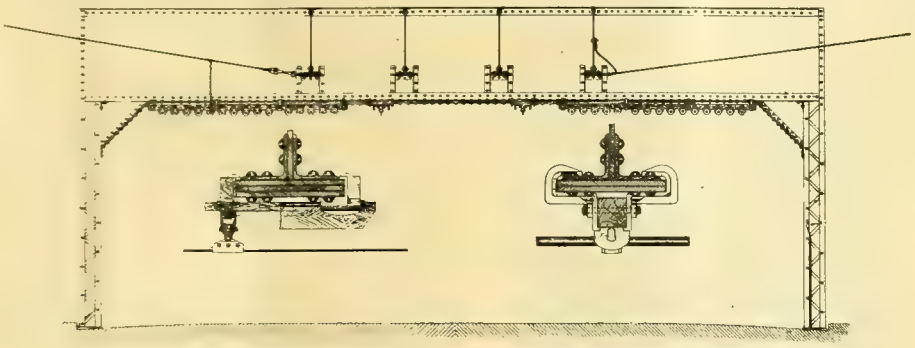



FIG. 10. THE ELECTRIC SYSTEMS OF THE NORTH AND WEST CHICAGO STREET RAILROAD COMPANIES.—LAKE STREET "L" ATTACHMENTS.

FIG. 5. THE ELECTRIC SYSTEMS OF THE NORTH AND WEST CHICAGO STREET RAILROAD COMPANIES.—ORNAMENTAL BRACKET POLE.

cast-iron pavement sleeve set in the concrete, the top of which is eight inches above the surface of the street and filled flush with paving pitch. The poles are fitted with an acorn top and at 22 feet above the curb carry a wrought-iron collar for the span wire, which holds the trolley at a height above the tracks of 18 feet six inches. At railroad crossings the collar is raised to carry the trolley 22 feet above the tracks. To these collars are bolted the Brooklyn strain insulators, manufactured by Albert & J. M. Anderson, carrying the five-sixteenths-inch galvanized steel strand on which straight line hangers are secured. These hangers have the mechanical clip manufactured by the New York Electrical Works. The trolley wire is No. 0 hard drawn copper, having a tensile strength of 45,000 pounds and an elongation of four per cent. The trolley and strand wire were furnished by the Washburn & Moen Manufacturing company, the John A. Roebling's Sons company and the American Electrical Works.

The feed wire spans are of insulated wire, 11 strands of No. 10 copper wire, and placed about five to the mile. The connection on a feed span to trolley and ground return to

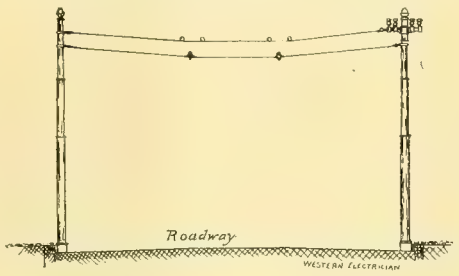



FIG. 4. THE ELECTRIC SYSTEMS OF THE NORTH AND WEST CHICAGO STREET RAILROAD COMPANIES.—STANDARD SIDE POLE CONSTRUCTION.

rails, as well as the lightning arrester, one of which is placed on each mile or section, are well shown in Fig. 7.

system or guard wire, is $3,000, about $2,000 of which is for the iron poles. No. 6 silicon bronze guard-wires are used where there is danger of falling telephone or other wires striking the trolley wire. This wire has a tensile strength of 80,000 pounds and is used double for the spans and single for the parallels. The longitudinal guard-wires are carried on porcelain spools on the upper span wire and are three in

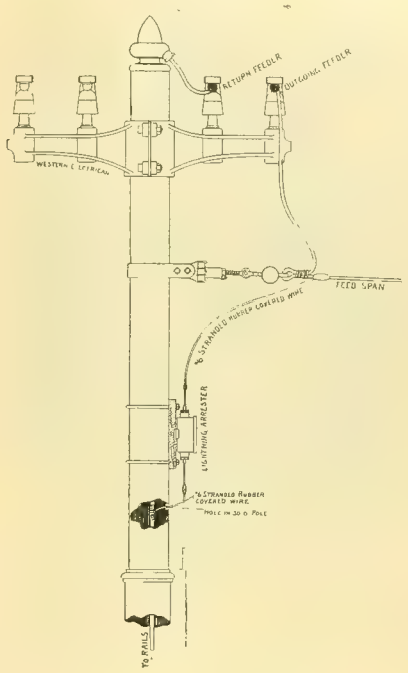



FIG. 7. THE ELECTRIC SYSTEMS OF THE NORTH AND WEST CHICAGO STREET RAILROAD COMPANIES.—CONNECTIONS ON FEED SPAN POLE CARRYING LIGHTNING ARRESTER.

number. The outer wires are 16 inches outside of trolley wires.

Malleable iron cross-arms are used, shown in Fig. 7, and are made for two pins, four pins and six pins. Pins are iron and the insulators are the Ætna central-bearing for positive and glass or galvanized iron for negative or return feeders. These cross-arms give good satisfaction, being lighter and more easily clamped to the pole than cast-iron unmalleable zed, and cost no more.

FIG. 3. THE ELECTRIC SYSTEMS OF THE NORTH AND WEST CHICAGO STREET RAILROAD COMPANIES.—SPECIAL TRACK WORK (CAR BARN ENTRANCE CURVES ON WESTERN AVENUE).

Curves are pulled from a bull-ring attached to the pull-off pole by large Brooklyn strain insulators. Double insulation is maintained at all points between any live wire and the iron poles. The cost of this construction of one mile of double track overhead trolley line, without feeder

*Feeder System.*—The feeder wire is both solid and stranded, the solid being No. 00 and No. 0000 and the stranded 350,000 and 500,000 circular mils capacity, principally of the latter

size. These conductors were furnished by the Washburn & Moen Manufacturing company, the American Electrical Works and the Chicago Insulated Wire company. The stranded wire is composed of 49 wires, made and laid like wire rope, seven strands of seven wires each and covered with triple braided coating.

The lay-out of the feeder systems of these companies was

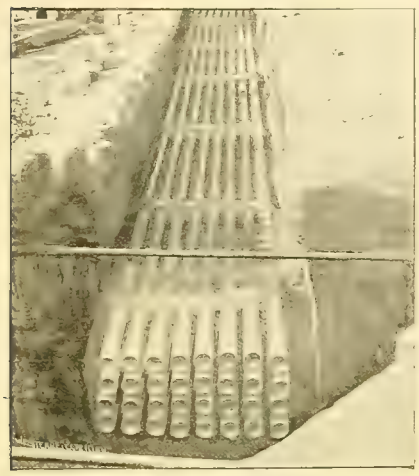


FIG. 17. THE ELECTRIC SYSTEMS OF THE NORTH AND WEST CHICAGO STREET RAILROAD COMPANIES.—CONDUIT TERMINATING IN MANHOLE.

perhaps as difficult and intricate a piece of electrical engineering as was encountered in the whole construction work. The three power houses supply a large territory, and as each mile of line constitutes an independent electrically isolated and insulated unit, with its own feeder or feeders, one can see that the calculation of the proper distribution of copper was a great problem. In Boston, for instance, a 500,000 circular mil feeder will supply 2,500 or 6,000 feet of line, depending on the traffic; and the length of a street section is fixed by what one feeder will supply. Here, however, it is different. Each mile constitutes one distinct and separate section, and feeders are run to suit the traffic and location of

FIG. 9. THE ELECTRIC SYSTEMS OF THE NORTH AND WEST CHICAGO STREET RAILROAD COMPANIES —CORNER OF WESTERN AVENUE AND LAKE STREET, SHOWING BOX POLE AND FEEDERS UNDER THE "L" STRUCTURE.

this mile. One 350,000 circular mil cable may be sufficient for one mile and two 500,000 circular mil feeders may be needed for another section at the same distance from the power house and of the same length but with a greater traffic. In calculating the size of feeder necessary, 25 to 50 per cent. is allowed for future growth of the traffic, and then, knowing the number of amperes necessary on that section from the number and headway of cars, the size of the feeder is determined by allowing a 10 per cent. drop from the voltage at the station.

An insulated overhead return feeder capacity of one-half that of the outgoing feeders is provided for each section, and, with the well bonded rails, ought to furnish a return circuit so efficient as to prevent any effects from electrolysis.

Feeders run to within a thousand feet of the extreme end of each section, and the farthest section from the power house feeding it is four miles distant, although now, until the Western avenue power house is ready to supply current, Van Buren street, Western avenue and Ashland avenue are fed from the California avenue power house, six miles away.

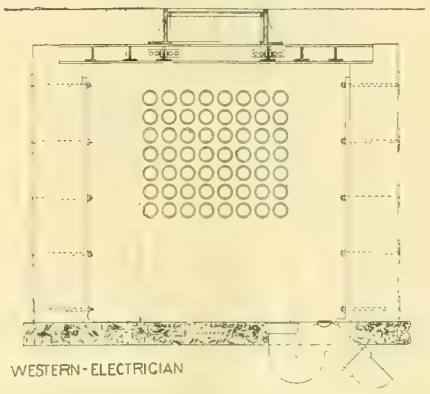



FIG. 18. THE ELECTRIC SYSTEMS OF THE NORTH AND WEST CHICAGO STREET RAILROAD COMPANIES.—MANHOLE FOR CONDUIT.

*Special Line Work.*—A special box pole is pictured in Fig. 8. The pole is of sheet-iron riveted on an angle iron frame, and conveys in its interior six cables, as shown in section, Fig. 8, from the underground conduit system on Western avenue to cross-arms bolted on its top, where the cables are connected to the overhead feeder system, as shown in Fig. 9, which is a reproduction of a photograph taken on Western avenue, at the north end of the conduit, on the north side of Lake street. These poles are 33 feet long, 16 inches square at the bottom and 10 inches at the top, and are securely anchored in the ground by the braced channels at their feet, buried seven feet in the ground.

Many special problems arose in the construction of attachments for the trolley wires and feeders to the elevated roads, viaducts and draw-bridges, and each had to be solved by the best methods for each particular case. Many designs for clamps, pole attachments, and even special trolley and feed wire insulators were made by the Electrical Department.

The Lake Street elevated will be underrun its entire length by a trolley line, and the attachments to the structure where the latter is low are shown in Fig. 10 (page 3). The trolley is carried by a special hanger in a short wooden trough, shown cut away in the left-hand section. The trough is secured by malleable iron clamps to the lower plates of the cross girders, and renders it impossible for the trolley pole to come in contact with the iron structure and the trolley wire at the same time and so cause a ground. The feeders are carried in special split Aetna insulators within cast-iron water-shields, bolted through a wooden arm, secured to the cross girder also by malleable iron clamps, as shown in the right-hand detail, Fig. 10. These feeders are a trunk line from the conduit on Western avenue, and even the space between the trolley wires will be occupied by feeders. A tap from a positive feeder to a side street is shown in the upper left-hand corner. The strain is conveyed through two Brooklyn insulators to a hook on one of the longitudinal girders. A metallic connection from a return feeder from an intersecting line to the structure is shown in the upper right-hand corner,

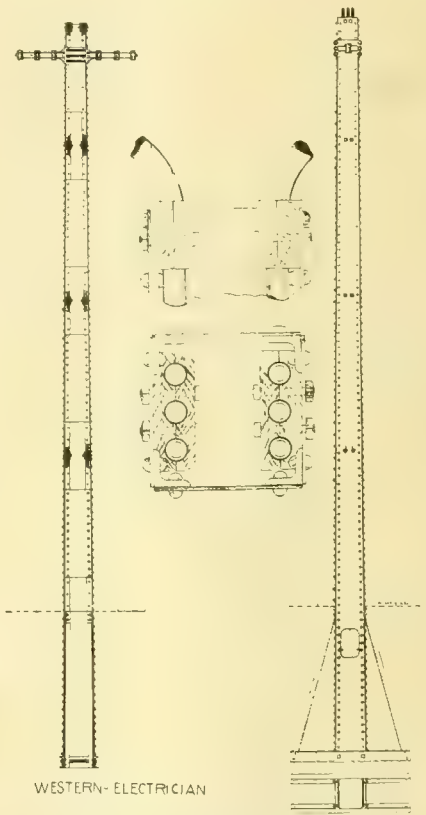



FIG. 8. THE ELECTRIC SYSTEMS OF THE NORTH AND WEST CHICAGO STREET RAILROAD COMPANIES.—BOX POLE.

and a metallic connection to rails is seen on the lower part of the right-hand column. Where the Lake Street elevated structure is high, the ordinary span construction is used, with the columns as supports instead of poles.

Fig. 9 shows the appearance at Western avenue and the Lake Street "L." This is the north end of the underground conduit from the Western avenue station, and the iron pipes containing feeders from the conduit may be seen ascending the columns, on both sides of the street, and connecting with the feeders on the under side of the structure. A box pole is also shown in the foreground of this picture. Here the feeders to run north on Western avenue come up to the service, and connect to the overhead line. There is another box pole 100 feet north of this one.

A cross-arm attached to the elevated structure at Ashland avenue is illustrated in Fig. 11 (page 7). This feed line runs north from this point, and it will be noticed that insulators are both above and below this cross-arm.

In Fig. 12 (page 7) is illustrated the rack for feeders on Western avenue viaduct, and the trough for the trolley under the lateral girders.

At the numerous draw-bridge crossings which occur, uprights and supports for the trolley wire are constructed on both bridge and approach. The trolley wire on the bridge has to be protected by a wooden trough. A photograph, Fig. 13 (page 7), shows the construction at Clark street bridge. A very substantial structure, of heavy wrought-iron pipe, is erected on both the abutment and the bridge on each side of the river. This structure supports the end of the trolle

wire, which passes through the bridge in a wooden trough. The trolley wires on both bridge and approach terminate in a brass pan with curved fronts, which are pressed into contact by springs, and cars run over this bridge with no difficulty whatever with the trolley pole. By a simple device current is cut from the trolley wire on the approaching tracks when the bridge is swung a few inches, rendering impossible the accident of a car plunging into the open draw by any failure of the electrical equipment.

Many of the crossings of the electric road with the steam railroads are provided with the Gibbs interlocking devices, rendering a collision impossible. By means of the ordinary interlocking levers the signals and derails on the intersecting roads are set as usual, with the difference that instead of a derail a "scotch block" is used to stop the street car, in case the danger signal is not obeyed. In addition to this the current is cut off from both trolleys, on an insulated section extending back about 500 feet on the approaching track. This is accomplished by the same lever that throws the safety signal on the steam railroads. The trolley over the crossing is always alive to prevent the stalling of an electric car on the tracks. These interlocking crossings were installed by the Union Switch & Signal company.

*Switchboards.*—The construction of the frame of the gallery type of switchboard used in all three stations of these companies is shown plainly in the sectional elevation, Fig. 14 (page 10). The machine panel and total output panel are secured in T-irons, on the lower board. Each panel on the upper board is for a feeder to a certain section.

The frame of these switchboards is made of I-beams and

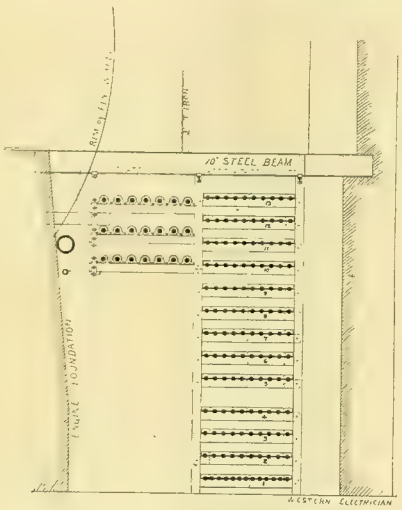



FIG. 15. THE ELECTRIC SYSTEMS OF THE NORTH AND WEST CHICAGO STREET RAILROAD COMPANIES.—FEEDER RACK AT WESTERN AVENUE STATION.

T-irons, and is insulated by fiber from the iron on the floor and wall. The details of the fiber bushings and washers at the joints are shown at *A* and *B*, Fig. 14.

The switchboard at California avenue has 40 feeder panels, that at Western avenue 76, and Hawthorne avenue station will have 20 panels for feeders. The lower board at Western avenue has seven panels, one for each of the generators, one for the total output and two at present unoccupied, in reserve for the addition of machines in the future.

The panels, furnished by the General Electric company, are of enameled slate and each feeder panel has an automatic circuit breaker, Weston shunt ammeter and a knife switch, and carries a mark of the number and location of its section. Each generator panel carries a circuit breaker, an ammeter and connection to a Weston voltmeter, main switches, the field switch and the field rheostat. The total output panel supports a Thomson recording wattmeter, which measures the entire current. At the Western avenue station two voltmeters are used, one connected to any machine at will and the other showing the voltage between the bus bars, so that the machine voltage may be exactly that between the bus bars when it is thrown in circuit. A lightning arrester on each feeder circuit is placed above each feeder panel. These instruments are all of the latest and finest design.

All the connections at machines and to the switchboard are led under the floor. The equalizer switches are placed at the generators and are protected by an insulating box from possible short-circuiting.

*Feeder Rack.*—To show what a problem it is to take care of so many feeders in the power house, a drawing of the feeder rack below the switchboard at the Western avenue station is reproduced in Fig. 15. The larger feeders on the left are from the generators leading to the switchboards. The outgoing feeders are designated by the solid dots, in the thirteen racks on the right. The rim of the flywheel barely clears the rack and the steam pipe shown. Above will be seen the switchboard frame.

*Feeder Tunnel.*—Fig. 16 (page 10) represents the shaft and part of the tunnel under the Chicago river at the California avenue station for the feeders from this station to the lines in the north part of the North Side. The lead covered feeder cables run some 50 feet from the basement to the tunnel and pass down under the river and up on the North Chicago

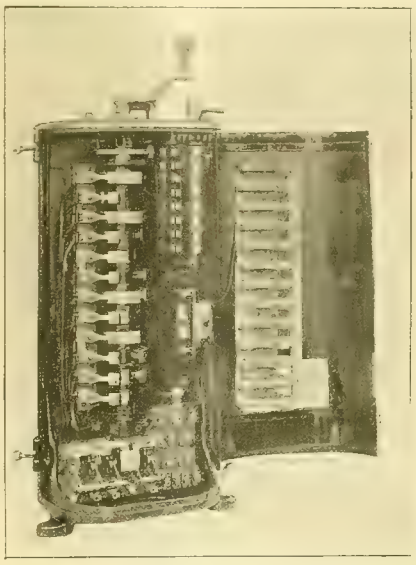


FIG. 27. THE ELECTRIC SYSTEMS OF THE NORTH AND WEST CHICAGO STREET RAILROAD COMPANIES.—CAR CONTROLLER.

side, whence they issue from a square iron tower at the height of a pole line, leading feeders to the desired points.

From the tower to Western avenue four 1,000,000 circular mils stranded and tinned bare copper negative cables are carried underground in a wooden box. They there come to the surface and join the overhead line.

*Conduit.*—The feeders from the power house of the West Chicago company on Washington boulevard run north and south on Western avenue in an underground conduit. Fifty-six ducts lead north to the Lake Street elevated road, an d

The conduit was manufactured and laid by the National Conduit Manufacturing company of New York. The ducts consist of sheet iron pipe of an outside diameter of 4½ inches, in eight foot lengths, lined with five-eighths inch of pure cement. One end of each length is provided with a convex and the other with a concave end ring, which form together a sort of a ball and socket joint. These tubes are laid in a trench, as shown in Fig. 17 (page 4), in layers on a three-inch bed of concrete, and each one is separated from its neighbor by one-half inch of concrete, and the whole collection of tubes is surrounded by a three-inch protection of concrete. The top of the conduit is about 2½ feet below the surface of the street. At Madison street it was necessary to sink the conduit to a depth of 16 feet to pass below the cable yokes and sewer mains.

The construction of manholes is shown in Fig. 18 (page 4). A drain pipe is shown imbedded in the bottom of the manhole, which is of six inches of concrete. The manhole is octagonal in form, of brick, and carries on the walls cast-iron racks for the feeder cables. The bottoms of these man-

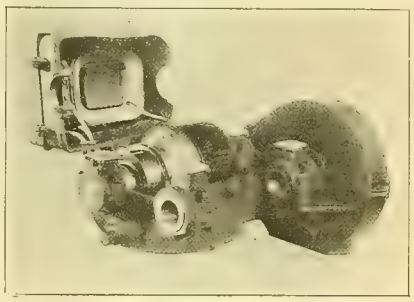


FIG. 26. THE ELECTRIC SYSTEMS OF THE NORTH AND WEST CHICAGO STREET RAILROAD COMPANIES.—CAR MOTOR.

holes are about seven feet below the surface of the street. It was necessary to depart from the regulation shape in constructing many of the manholes, on account of obstructions encountered.

After the conduit is completed a steel mandrel, carrying two steel disks, 2¾ inches diameter, is pushed through each duct by means of screwed rods in sections five feet long,

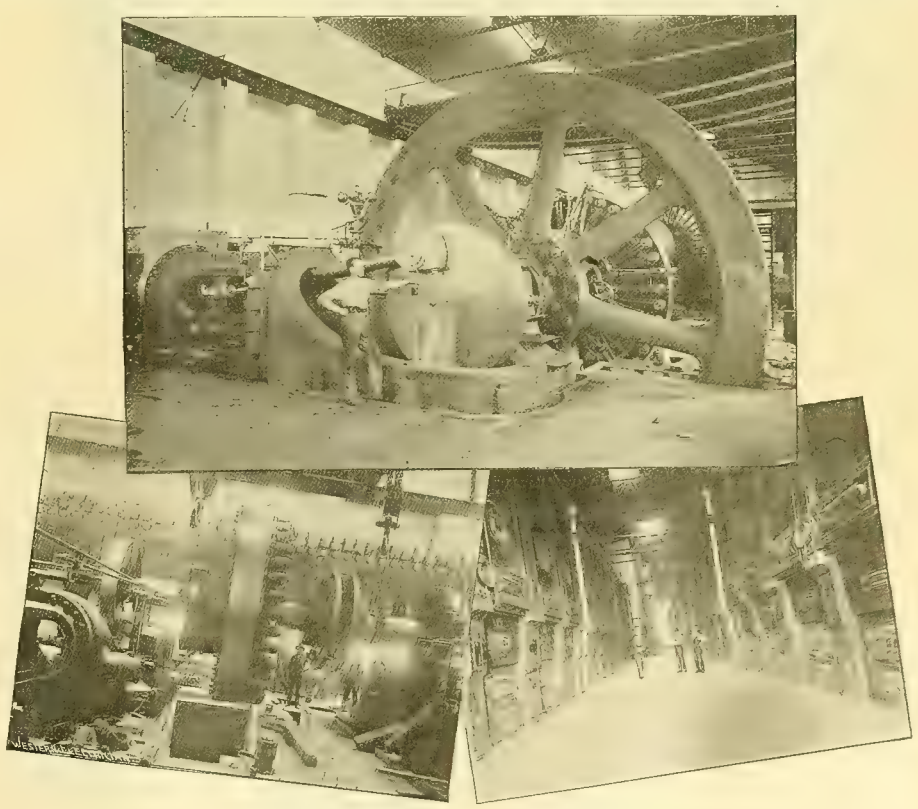


Fig 22. Engine-dynamo of 2,000 Horse Power.
Fig. 23. Eighty-five Tons in the Air. Fig 21. Boiler Room.

THE ELECTRIC SYSTEMS OF THE NORTH AND WEST CHICAGO STREET RAILROAD COMPANIES.—VIEWS IN THE WESTERN AVENUE STATION.

the same number start south to Fourteenth street and at the crossings of the east and west lines feeders are brought to the surface and up inside the special box poles and connected to the overhead system, so that the number of ducts diminish as they extend south. Manholes are placed at each street intersection and in some places at both corners of the intersecting street. Altogether there are 350,000 feet of duct and 51 manholes.

after which a lead wire is drawn for the purpose of attaching a rope with which the cables are drawn through the duct.

In the conduit is drawn a total of 270,000 feet of lead covered rubber insulated stranded cable, furnished and drawn by the Safety Insulated Wire & Cable company of New York. This cable is mostly of 350,000 circular mils, but some is of 500,000 circular mils. This cable is spliced

[*Continued on page 7.*]

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TO-DAY the WESTERN ELECTRICIAN enters upon the ninth year of its existence. It rejoices in its own success and extends congratulations to all its friends. It renews assurances of continued devotion to the interests of its old patrons, and wishes them all many years of uninterrupted prosperity, while for the younger members it entertains the same kindly feeling, offering encouragement and assistance in every way that will enable them to gain prominence and power in their respective fields.

During the eight years of its history this journal has labored unceasingly in the interests of the electrical fraternity, and it is gratified to feel that its work has been appreciated, and to see on every side evidence of the progress that has been made in following the policy it has suggested. It has consistently advocated the establishment of electric roads in Chicago, and to-day it is rewarded by seeing the great work of transformation from horse to trolley cars accomplished. This change was not brought about without much opposition, but now that it has been accomplished this journal takes pride in considering its part in the undertaking. Another cause to which it has of late given special attention is the development of the telephone field. It has been the policy of the WESTERN ELECTRICIAN to encourage the promotion of legitimate enterprises in this line, and thus assist in the development of this department. In his, as in other important undertakings, it has had valuable assistance from the great daily papers of Chicago, which it desires to acknowledge. One of these in particular, the *Chronicle*, has taken up the subject of the telephone and has contributed much to the success thus far obtained. Many other examples, showing the far-reaching influence of this journal, might be cited, if necessary. It is sufficient to add that it retains its commanding position among class publications, and that in the character and excellence of its special features it is superior to any of its contemporaries. The present volume, it is hoped, will show marked improvement. It will continue to abound in attractive illustrations and present exclusive news. The list of special contributors, already large, is being added to constantly, and every development in modern engineering practice will receive prompt and intelligent consideration.

IN the last issue of the WESTERN ELECTRICIAN the experience of Frank A. Grover at Rochester, N. Y., was described, and his remarkable resuscitation, after he had apparently been dead for some time, was recorded. It is not at all surprising that this remarkable experience should once more suggest the idea that further examination into the effect of electric current upon the human body should be made before any more electrical executions be performed under the present law of New York state. Superintendent Redman of the company in whose plant the accident occurred says that the work of resuscitation was done by the three workmen whose names were mentioned in last week's article, and that they followed the D'Arsonval theory. The victim of the accident had already shown signs of returning animation before the arrival of the physicians. It should be noted that while there have been many instances of the same character, either through accident or experiment, the case of Grover is peculiar in this—that the shock was heavy, the death apparently certain, and the resuscitation deliberately planned and carried out in accordance with medical forecast. Whatever effect this incident may have on the life of the present law in New York state, certain it is that the experience will prove valuable to the community, as it demonstrated that with intelligent application of simple methods many victims of electric shocks can be reclaimed from death. The subject should be carefully studied by every person engaged in any way in the handling of electric current, and it would be well, too, for the general public to become familiar with the subject.

WHEN one stops to consider the magnitude of the electric railway interests of Chicago the figures are astonishing. On surface lines alone the three principal companies will have, when the work under way is completed, as it will be in a few months, electric lines having a total trackage of 335 miles. This is equivalent to a continuous double-track railway 167 miles in length. To supply power to the car motors on these lines, engines and generators aggregating in capacity 27,500 horse power have been or are about to be installed. In addition, the four elevated railroad companies of the city, which have in operation or under construction, at a conservative estimate, about 85 miles of track, are certain to make use of electric power. One already does so, another awarded the contract for electrical equipment last week, a third, under construction, was planned from the first as an electric line, while the fourth, the oldest of all, must replace its steam locomotives by electric motors to place it on a paying footing. To make the transformation all-embracing, the great steam railroad companies that handle the bulk of Chicago's enormous suburban passenger traffic are all considering the advisability of substituting electric power for the existing steam service, and one or two have decided to do so. This marvelous change has been brought about within a period of three years. Chicago was slow in adopting the electric railway, but once the decision was made the work was pushed with characteristic energy and vigor.

It is fitting that the greater portion of this anniversary issue of the WESTERN ELECTRICIAN should be devoted to matter pertaining to this epoch-making transformation. Mr. Hagar's comprehensive article describes the extensive equipment of two companies, which, under the dominating influence of Charles T. Yerkes, are operated in conjunction. Here alone are 210 miles of track and a generating capacity of 20,000 horse power. The details of construction and operation are of great value and interest and are set forth by the author in a clear, practical style. The power houses have no frills, but are fine examples of simple, thorough engineering practice of the best class. The electrical line construction, laid out with reference to Chicago's numerous steam railroad crossings, drawbridges, viaducts and elevated railway structures, is varied and elaborate, and the full description furnished is replete with details of much practical value. The article is one of the most complete expositions of electric railway work ever published, and the section on "Electrical Construction" in particular should be read by all interested in this important branch of electrical engineering.

WHEN the city of Chicago established its first electric plants for lighting the streets of the business district, the promise was made by Superintendent Barrett that the service would be much better and far less expensive than if provided by private enterprises. After the plants had been in operation some time, the announcement was made upon the same authority that the city was getting its arc lights for streets at a cost of $73 per lamp per year. Of course, this statement was made for the purpose of satisfying the public that the scheme was an advantageous one for the city. This announcement created no end of trouble in other cities where private companies were furnishing lights, and, although experts in the business pronounced the figures absurdly low, city officials refused to accept the denials, but persisted in quoting "Prof. Barrett's figures." When called upon for an explanation the Chicago city electrician refused to divulge any information. It was then that an investigation was made independent of the officials in charge of the department, and the result is shown in the paper presented by M. J. Francisco on "Municipal Lighting" at the Cape May convention of the National Electric Light association in August, 1890. In this paper Mr. Francisco said:

The city electrician will need to add something more to his stereotyped answers that the cost of the city lights "does not include any expense such as you mention—taxes, water rent, interest on investment, insurance, repairs, depreciation or renewal of plant in general;" neither will it be expedient to charge the wages of the electric linemen to the fire alarm telegraph department, notwithstanding it works very nicely now, and helps wonderfully to make the cost of an arc light appear small. Upon investigation of one of the stations of 275 to 300 light capacity, I find that the chief engineer receives $1,200; assistant, $1,030; four firemen, $2,880; six trimmers, $3,240; line tester, $720; three linemen, $2,520; cost of carbons, $3,800; fuel, $12,000; interest, $14,000; depreciation, 2½ per cent., $8,750; oil, waste, repairs, globes, taxes, etc., $7,000—making $57,190 a year expense for running 300 arc lamps, being $190.63 per year per lamp, and this makes no provision for salary of electrician, superintendent, or for armatures burned out or any accident or damages. With the linemen's wages charged to the fire alarm telegraph department, we can reduce this $2,520. Now, to what other department do they charge the other expenses to reduce it to $73 per year per lamp?

When Supt. Barrett was called upon for an explanation of the statements attributed to him by the newspapers, he refused positively to present any figures. He said that he had never seen a tabulated statement of what it cost a commercial company to furnish light, and for that reason he refused the information desired. It was pointed out that as a public official he was in a different position from the men who had their own money invested. He was spending the taxpayers' money, not his own. He admitted later that the affairs of the department were in such condition that it would be almost impossible for him to present a true statement of the exact cost of the plant per lamp per year. This statement was repeated in 1891 to the committee of Milwaukee aldermen who visited Chicago for the purpose of finding out the cost of lighting the city streets. It is a remarkable fact that these friendly visitors obtained no more information than did the managers of central stations who questioned the accuracy of "Prof. Barrett's figures" at Cape May. In the case of the Milwaukee aldermen it should be remembered that they had started out with the expectation that they would secure some valuable information, but from the report they made on their return it appears that "In an interview of an hour and a half Mr. Barrett positively refused to answer the questions propounded by the committee. The committee assured Mr. Barrett that his opinion was held in the highest regard, but what was wanted was the actual cost of establishing and operating the Chicago plant. To this Mr. Barrett replied that the many difficulties incident to the establishment of the plant had rendered its affairs in such a state of chaos that how to arrive at even an approximate statement was decidedly beyond his comprehension." Yet all this time "Prof. Barrett's figures" were being industriously circulated throughout the country, and central station managers seeking city contracts were confronted with the question: Why cannot you furnish light at $73 per lamp per year?

In view of these facts the city of Chicago should hesitate before further engaging in the business of electric lighting. It is evident that thus far the department has not conducted the business of lighting the streets as carefully as a private corporation would. To-day it is apparent that no more is known of the actual cost of electric lights operated by the city than in 1891, when it was admitted that absolutely nothing was known of a certainty. In view of these facts, how can any sane man honestly advocate further extension of municipal lighting?

## The Electric Systems of the North and West Chicago Street Railroad Companies.

[Continued from page 5.]

in the manholes about every 400 feet. The return feeders in this conduit are of 1,000,000 circular mils bare, stranded and tinned cable, and are connected with the track at alternate manholes by a wire built into the side of the manhole, and fastened to the rails.

### I.—POWER HOUSES.

As before stated, the power houses are three in number and are marked on the map, Fig. 2, by the circles around them. One near California avenue at Roscoe boulevard, that of the Chicago Electric Transit company, is at the head of the north branch of the Chicago river, is run condensing and has a present capacity of 2,000 kilowatts and an ultimate capacity of 3,000 kilowatts. The second, that of the West Chicago company, is located at the corner of Western avenue and Washington boulevard. This is a non-condensing station, with apparatus in process of completion to turn out 5,300 kilowatts, and an ultimate capacity of 9,000 kilowatts, or 12,000 horse power. The station of the North Chicago company is on the north canal on Hawthorne avenue, between Chicago avenue and Division street. This station will soon be ready to receive 2,400 kilowatts of generators and will have a total, finally, of 3,200 kilowatts. Of course condensing is in order here.

*California Avenue.*—The California avenue power house, Fig. 1, was illustrated and briefly described in the WESTERN ELECTRICIAN of May 4, 1895. The generating units are four in number, each consisting of a Siemens & Halske 500 kilowatt type I, eight-pole generator on the shaft of a Fraser & Chalmers cross compound Corliss engine with cylinders 24 inches and 40 inches in diameter by 48 inches stroke, running at 85 revolutions per minute. These generators are guaranteed to carry an overload of 33⅓ per cent. and have already had a greater overload than this. Space is provided for two more units of the same size.

The engine receivers are in the engine foundation, and the Blake jet condensers and air pumps are placed under the floor, between the foundations for the engine cylinders. A quick change can be made to atmospheric exhaust. These engines are oiled by the air pressure system of the Wilson-Whiting-Davis Oiling company of New York. A Westinghouse air-pump supplies the pressure of 15 pounds in the distributing tanks, one for the engine oil and one for the cylinder oil. The oil passes through filters to oil cups on the engines, which are supplied with regulating sight feeds. There is also one valve controlling the supply to the cups on each engine. The waste oil is returned by gravity, filtered and used again. The compressed air is also used to clean the switchboard and generators.

There are ten Campbell & Zell water-tube boilers in five batteries, composed of two boilers of 600 horse power each, in which a steam pressure of 150 pounds is maintained. These boilers are equipped with the Murphy furnace, although until very recently oil was burned. Ash hoppers are provided and arrangements are made for installing coal and ash handling machinery at any future date, and now that the change has been made to coal as fuel, this apparatus will probably be installed.

The feed-water from the river is purified in two Jewell gravity filters with an agitating wash, and is pumped by two 12 by 7 by 12 inch pumps of the Blake admiralty type. A Worthington meter is placed in the feed-water main. There is a supplementary equipment of Metropolitan double tube injectors.

There are four 1,000 horse power horizontal Berryman heaters between the engines and two 2,000 horse power vertical Berryman heaters in the boiler room, which, with the pumps, are arranged on the sides of the octagonal stack, which is 200 feet high, with a 14 foot flue. The feed-water is heated by being passed in succession through the heaters, connected between the engines and condensers in operation at the time, and then through the vertical heater in the boiler room. The feed-water then passes through a Whitmore-Dean automatic electro purifier at the back of each boiler, whose object is to prevent the formation of scale in the boiler by destroying the affinity between the scale-forming particles in the water.

The steam and water piping and connections are beneath the floors, the steam header being suspended in chains beneath the engine cylinders, and is provided with U-loops, to allow for expansion. The Westinghouse return loop system is in use to return the condensed steam from the headers, separators, cylinders, etc., and Westinghouse separators are placed at each engine.

The building is fire-proof, of brick, with an iron roof. A brick wall, with an extension to the roof of corrugated iron, separates the engine and boiler rooms. The engine room floor is of iron plates and that of the boiler room of cement on brick arches. A twenty-ton Walker hand power crane travels the length of the engine room. Corrugated iron shields are placed above the generators to protect them from any dropping water, from condensation on the roof.

*Western Avenue.*—This power house is built on much the same lines as the California avenue station. The photograph, Fig. 1, gives an idea of its exterior and the two drawings, Figs. 19 and 20 (page 9), show plan and elevation of the interior. The dimensions of the building are 250 feet long by 125 feet wide, with an engine room 57 feet and a boiler room 64 feet wide in the clear. The octagonal stack is 220 feet high with a 16 foot flue on a base 27 feet square, resting on a foundation 48 feet square, and is said to be the largest brick chimney in Chicago. The flues to the stack from the boilers are lead underground, as shown in the plan of the station. This building is of the same construction as the power house previously described.

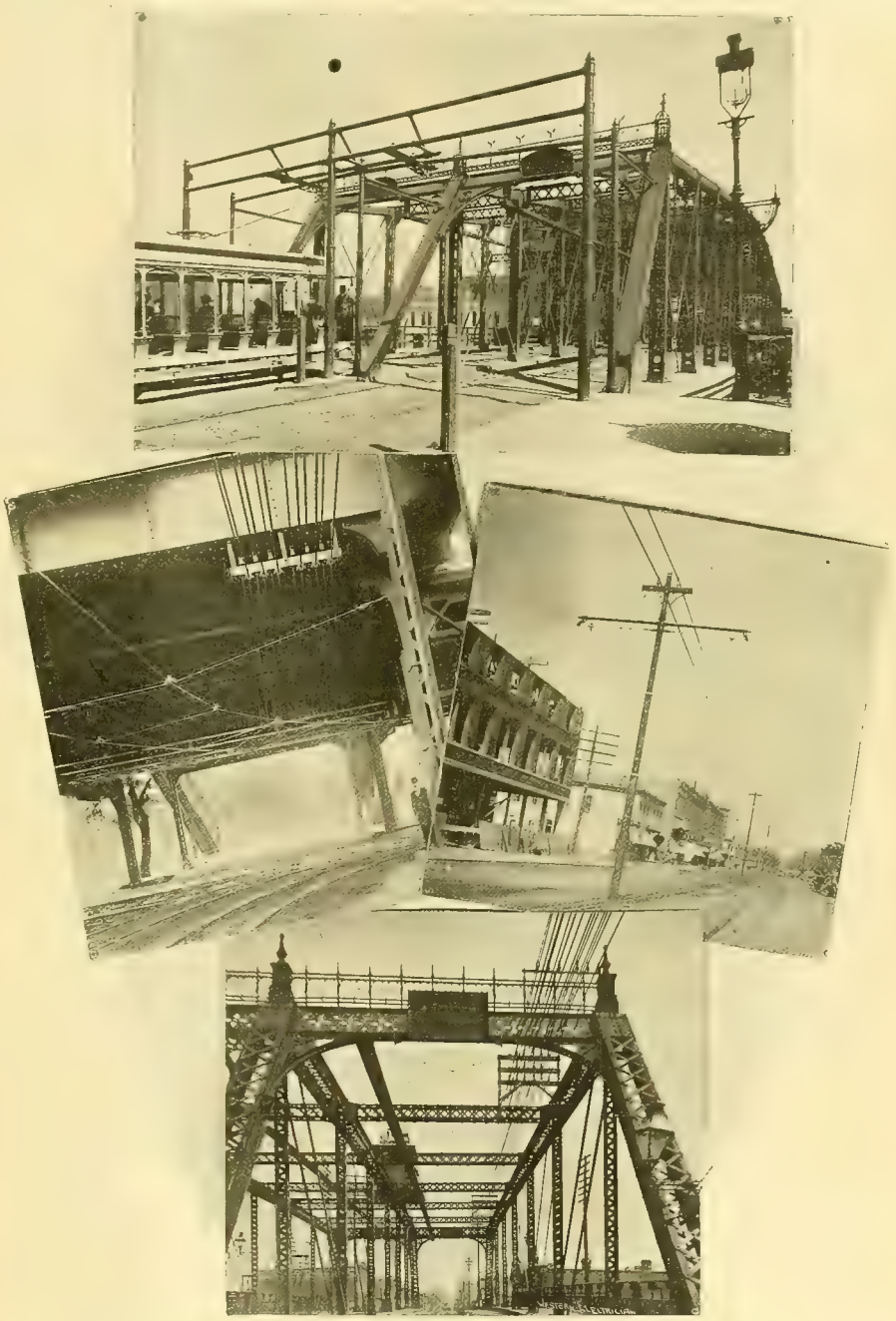


Fig. 11 Ashland Avenue and the Lake Street "L"

Fig. 13. Structure at Clark Street Bridge.

Fig. 12 Feeder on Western Avenue Viaduct.

Fig. 6. Center Pole Construction

THE ELECTRIC SYSTEMS OF THE NORTH AND WEST CHICAGO STREET RAILROAD COMPANIES.—EXAMPLES OF OVER HEAD WORK.

The equipment at present installed, or in process of erection, consists of ten batteries, each of two 400 horse power Stirling boilers, making a total of 8,000 rated horse power, carrying steam at 140 pounds pressure, a view of which is shown in Fig. 21 (page 5); one 1,000 horse power cross compound Fraser & Chalmers engine, with cylinders 26 inches and 40 inches in diameter, with a 48 inch stroke, running at 80 revolutions per minute, carrying on its shaft the armature of a 750 kilowatt, 12-pole Siemens & Halske generator; and three 2,000 horse power engines, with dimensions 34 inches and 54 inches by 60 inches, with a speed of 75 revolutions per minute, of the same make, direct-coupled to 1,500 kilowatt generators of the same type. One of the large units is shown in Fig. 22. The 25 foot flywheel weighs 80 tons.

The general equipment is the same as that of the previously described station, with the exception that this station is non-condensing, and is to use oil for fuel. There are two 35 ton Walker hand power cranes. A photograph, Fig. 23, shows the two cranes together, supporting the shaft crank disk, flywheel center and armature for the second large machine being installed. This piece, hanging clear, weighs 85 tons.

Berryman heaters, Westinghouse separators and return loops, Blake admiralty pumps, Metropolitan injectors, Wilson-Whiting-Davis oiling system are used here, as at California avenue, and the system of steam piping is arranged on the same plan.

It is expected that current will be turned out from this station about the time of publication. The ultimate capacity of this station is 12,000 horse power.

This power house and the California avenue station were designed by, and under the charge of, S. Potis, Jr., the chief engineer of the West Chicago Street Railroad company.

*Hawthorne Avenue.*—The power house of the North Chicago Street Railroad company is shown in plan in Fig. 24 and elevation in Fig. 25 (page 8), while an exterior view is obtained by the photograph in Fig. 1. This station differs from the other two in having a flat wooden roof and in general arrangement of machinery. The building

is 130 feet wide and about 150 feet deep, running back to the canal. The round stack has a 10 foot flue and rises to the height of 220 feet.

The engines will be three in number, at present, with space allowed for another unit. The engines are to be cross compound condensing Reynolds-Corliss, carrying the armature of an 800 kilowatt 10-pole General Electric railway generator on the shaft. The engines have cylinder diameters of 24 and 46 inches, with a 48 inch stroke. The low pressure cylinders are jacketed. The main shaft is 22 inches in diameter with a flywheel 20 feet in diameter, weighing 50 tons. These engines will run at 80 revolutions. The generators are guaranteed to give a commercial efficiency of 94 per cent. and a rise of temperature not to exceed 50 degrees Centigrade.

Ten 350 horse power Standard water-tube boilers, manufactured by the Link Belt Machinery company, will supply steam at 130 pounds pressure. Blake air pumps and jet condensers will be used, and the same system of feed-water heating will be employed as described at California avenue, using Berryman heaters. The boiler feed pumps will be of the Worthington admiralty type and the feed water purified by Jewell filters. An equipment of four Metropolitan injectors will provide for an emergency in case of breakdown of pumps. The Westinghouse return loop and Wilson-Whiting-Davis oiling system are also to be used here.

This building is now nearly completed and the machinery is being installed.

V. CAR EQUIPMENT.

The car equipment consists of two G E 800 motors with the General Electric type K2 series parallel controllers. These motors have the side bar suspension, where the weight of the motor is taken off the axle, so that of the total weight of 1,500 pounds only 500 is on the axle.

The illustration on page 5, Fig. 26, shows the G E 800 motor with the upper field thrown back and shows the trunnion below the armature for the sidebar suspension attachment. Fig. 27 represents the controller of the latest type, the K 2, and gives a good view of the finger points and the magnetic blow-out.

Many of the old horse cars have been fitted over with the electrical equipments, and a large number of new cars have been bought of the Pullman and the Brownell companies. Most of the equipments run on Brill trucks.

Six electric heaters of the American Electric Heater company and Consolidated Car Heating company are used in each car. The new "low bridge" trolley of the General Electric company enables the cars to run under the elevated roads, across bridges and into the barns.

The great success of the electric dummies made from abandoned gas-motor cars, placed on new Brill trucks, on the Garfield and Webster avenues loop for drawing trailers, has resulted in the West Chicago company ordering some sixty similar cars to operate West North avenue and other lines on the West Side, and the North Chicago company will also operate some other lines with these dummies.

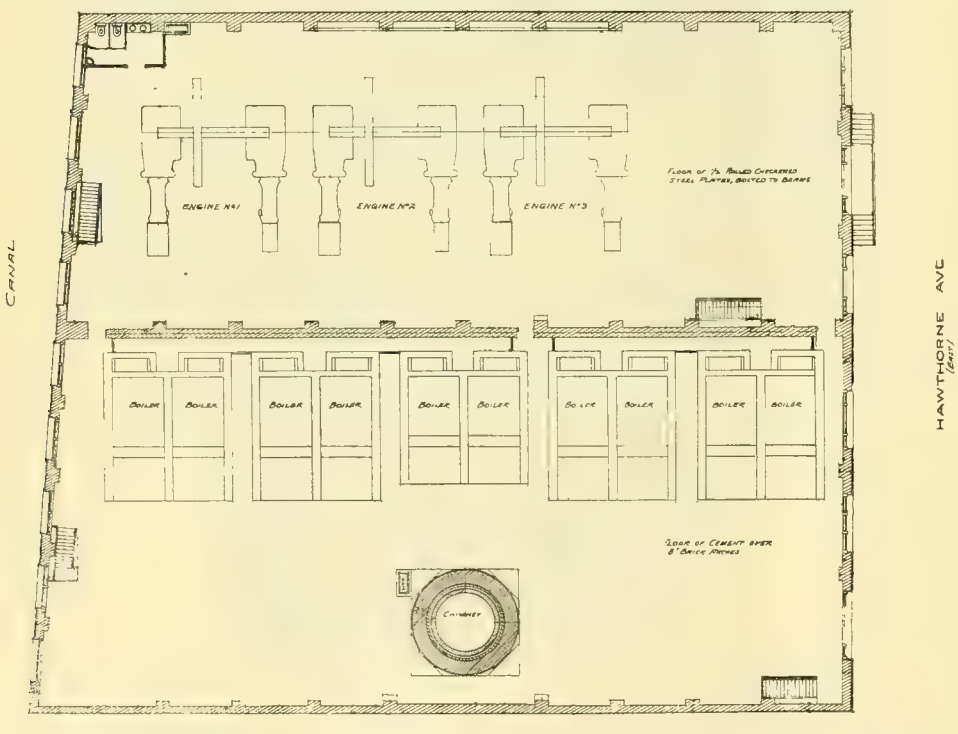



FIG. 24. THE ELECTRIC SYSTEMS OF THE NORTH AND WEST CHICAGO STREET RAILROAD COMPANIES.—FLOOR PLAN FOR HAWTHORNE AVENUE STATION.

# GENERAL MEETING

## Of the American Institute of Electrical Engineers at Niagara Falls.

The twelfth general meeting of the American Institute of Electrical Engineers at Niagara Falls was opened auspiciously on Tuesday morning June 25th at the Cataract House, where the sessions were held. At 10:30 o'clock Secretary Ralph W. Pope introduced Dr. Louis Duncan, the newly elected president of the Institute, who in turn introduced Mayor O. W. Cutler. The mayor extended a cordial welcome to the members of the Institute.

The reading and discussion of papers immediately followed the mayor's address of welcome. The first paper was that by Walter E. Harrington of Camden, N. J., upon the "Properties of Fuse Metals when Subjected to Short Circuits." This was followed by a long discussion. Charles P. Steinmetz's paper on the "Theory of the General Alternating Current Transformer" wasdiscussed by Prof. Pupin and others. The closing paper of the morning session was "Location of Grounds in Armatures, Fields, etc.," by Clarence E. Gifford of Jamestown, N. Y.

At two o'clock Tuesday afternoon the members and guests drove to the power station of the Niagara Falls Power company. They were admitted to the power house and transformer house and given every opportunity to examine the apparatus in detail. Dynamo No. 1 was run at its full speed of 250 revolutions per minute for the benefit of the visiting engineers, and a load of something over 3,000 horse power was placed on the generator. It was said that the governor was doing even better than had been expected. While the generator was running with a load of 3,000 horse power, 2,000 horse power was suddenly thrown off with only an increase of speed of seven revolutions. Many of the visitors went below and saw the shafting, bearings, pumps, lubricating apparatus, etc., and were profuse in their expressions of approval regarding all that they saw about the works. Resident Engineer Brackenridge, Mr. Bauman and Contractor Douglass, Electrician C. F. Scott and Assistant Manager Stillwell of Westinghouse company explained details and showed the visitors everything in the station. From the power house the visitors were driven to the Pittsburg Reduction company's plant, which is now ready to start when the power is available. The superintendent announced that the plant may begin operation within two weeks and that power is likely to be given it any day for trial. The Carborundum Works, the paper mill hydraulic plant and the Buffalo & Niagara Falls Electric Light & Power company's station were then visited, closing the afternoon's trip.

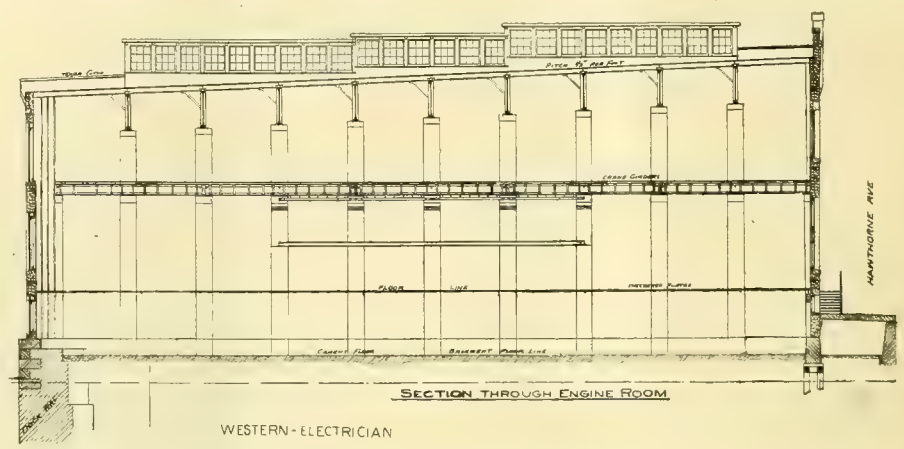



FIG. 25. THE ELECTRIC SYSTEMS OF THE NORTH AND WEST CHICAGO STREET RAILROAD COMPANIES.—SECTION ELEVATION FOR HAWTHORNE AVENUE STATION.

At the Tuesday evening session Prof. Anthony presided, and two papers were read and discussed: "The Substitution of Electricity for Steam in Railway Practice," by the president, Dr. Louis Duncan of Baltimore, and "Compounding Dynamos by Armature Reaction," by Prof. Elihu Thomson of Lynn, Mass. The discussion of Dr. Duncan's paper was participated in by Charles P. Steinmetz of Schenectady, Oberlin Smith and others. Mr. Steinmetz said of electric street railway work in cities, that there would be no use of expecting anything better than the 500 volt direct current motors with the underrunning trolleys. Of the second class the suburban, elevated and railway traffic between villages and cities, such as New York city and Boston, and lines to surrounding towns, the difficulties in these cases, Mr. Steinmetz thought, might be met in two ways: First, by direct current motors run in series on 700 to 1,000 volts outside of cities and in parallel at 500 volts inside of the cities; or, secondly, by using direct current motors supplied at 500 volts from rotary converters at sub-stations, which might be fed from high-tension alternating lines. The third class mentioned by Mr. Steinmetz was the long trunk lines now using steam locomotives which, he said, might be expected be operated in the near future by alternating current motors, to be run on potentials from 100 to 500 volts and supplied from step-down stationary transformers which would be supplied by high-tension alternating current lines. He said there was little chance of installing electrical apparatus on trunk lines, unless they could assure a speed exceeding steam practice, which reached as high as 90 and 100 miles per hour. Mr. Steinmetz thought that by using electric motors and avoiding the reciprocating parts of the steam locomotive the speed could be increased to 125 or 150 miles per hour. He said he had tested an alternating street railway motor built by himself at the General Electric works at Schenectady and found that the starting torque could be made all that was desired for railway work, and he showed curves of tests he had made upon the motor which proved very satisfactory. He added that the induction motor with no brushes or commutator would be found all that could be desired for trunk lines and high speed railway work, and he predicted that it would not be long before the steam locomotive would have to give way to the electric locomotive in many instances, and that ultimately electricity would replace steam entirely in railway practice.

WEDNESDAY, JUNE 26TH.

The morning session was well attended, notwithstanding that the temperature had risen considerable in 24 hours. The first paper presented was on "Electric Power in Factories and Mills," and was read by Dr. Francis B. Crocker of New York. There was considerable discussion upon it, and it was eulogized as a very important paper. It is a subject in which Niagara Falls is interested. The other paper on the programme for Wednesday morning was "Some Observations on a Direct-connected 300 Kilowatt

"Monocyclic Alternator," by Prof. D. C. Jackson and S. B. Fortenbaugh of Madison, Wis. There was placed on exhibition in the convention parlor Wednesday morning in a handsome frame a beautifully engrossed copy of resolutions adopted after the sudden death about three months ago of George May Phelps, for many years treasurer of the American Institute of Electrical Engineers. These resolutions were printed in the WESTERN ELECTRICIAN, April 27, 1895.

Wednesday afternoon the engineers walked across the upper bridge and took a trip over the Niagara Falls Park

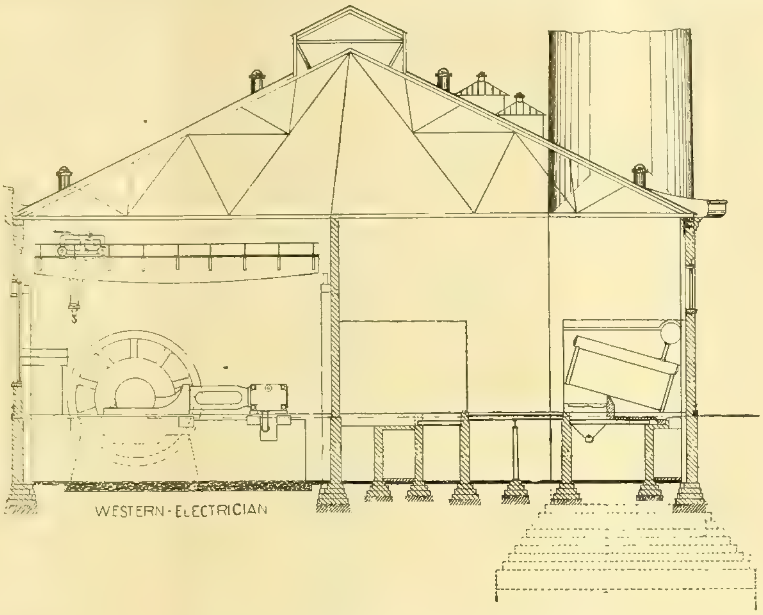



FIG. 20. THE ELECTRIC SYSTEMS OF THE NORTH AND WEST CHICAGO STREET RAILROAD COMPANIES.—SECTIONAL ELEVATION FOR WESTERN AVENUE STATION.

and River railroad, a total run of 28 miles, with constantly changing scenery.

The programme for the evening session included a paper by Dr. Charles E. Emery of New York on "The Cost of Steam Power."

A partial electrical test was made of the generator No. 1 at the power house Wednesday and the dynamo was loaded to 5,025 horse power and driven at its rated speed, the governor acting very satisfactorily.

THURSDAY, JUNE 27TH.

At 10.15 A. M. Dr. Duncan called the meeting to order. Dr. C. E. Emery replied to comments on his paper on "The Cost of Steam Power," and then the first paper of the morning was read by Dr. Albert M. Bleile of Columbus, O., on "The Cause of Death in Electric Shock." Discussion followed by Prof. Elihu Thomson, Prof. Wm. A. Anthony and others, and it finally developed into a sort of experience meeting of those who had received serious shocks. At 11.30 George H. Winslow of Pittsburg was introduced and read his paper on "Long-distance Power Transmission at Ten Thousand Volts." Following this paper Dr. C. E. Emery gave his paper on "Alternating Current Curves," in order that the evening would be open for the papers of L. B. Stillwell and Dr. Coleman Sellers, which were to be illustrated by lantern slides.

In the afternoon a party of those who had arrived since Tuesday visited the power house and Pittsburg Reduction company's works, while the others visited the Observation Tower, Buttery Elevator and Prospect Park. Mr. Bauman, the inventor and designer of the governor and turbines at the power house, stated that the generator was loaded to 5,335 horse power, and the whole system worked to perfection. The full capacity for which the generator and turbines were designed is 5,400 horse power. Mr. Bauman said that a test of the governor was made Thursday afternoon while visitors were there, and 3,100 horse power was thrown off, resulting in a difference in speed of only 18 revolutions, while the turbine was revolving 268 revolutions per minute. He said he would not hesitate to throw off the entire load of 5,335 horse power, which would be something unprecedented in turbine governor practice. He announced that probably on Friday or Saturday current would be supplied to the Pittsburg Reduction company's rotary converters for a test or trial. Mr. Bauman cabled Faesch & Piccard the results of these wonderful experiments made while the American Institute meetings were in session.

In the evening Ralph W. Pope gave an abstract of the paper by Franklin L. Pope of Great Barrington, Mass., on "Notes on the Reconstruction of a Small Central Station Plant," and after a short discussion by Dr. Emery, Dr. Duncan introduced Dr. Coleman Sellers, who gave an illustrated talk on "The Mechanical, Hydraulic and Civil Engineering Features of the Work of the Cataract Construction Company." Dr. Emery suggested a vote of thanks to Dr. Sellers for his interesting lecture, which was given, after which L. B. Stillwell of Pittsburg continued the subject by taking up the "Electrical Work of the Westinghouse Electric & Manufacturing Company for the Cataract Construction Company of New York."

Dr. Sellers gave an interesting account of his trip to Europe to meet Mr. Adams, and how the Niagara International Commission was formed. He stated that the prizes amounted to $22,000 and that of all the schemes submitted in 1891 none was considered practicable at that time. They wished to consider any and all systems, including compressed air, electricity, cable, etc., and would adopt that which would make it a commercial success and by which they could be assured the most money could be made.

The commissioners decided that if 50,000 horse power was to be used in one building the units must be 5,000 horse power.

Faesch & Piccard of Geneva, Switzerland, were finally selected as designers of the turbines. They were calculated to deliver 5,000 horse power each at 250 revolutions

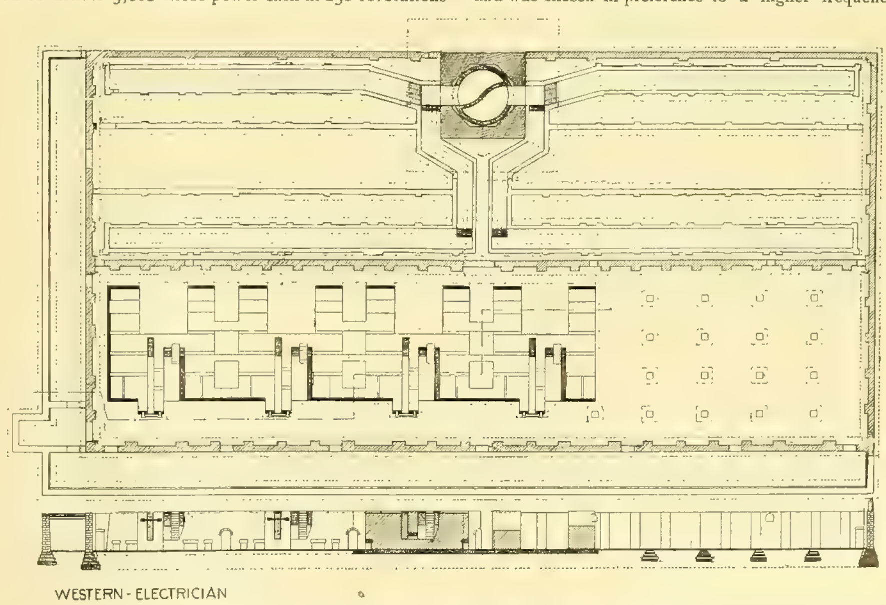



FIG. 19. THE ELECTRIC SYSTEMS OF THE NORTH AND WEST CHICAGO STREET RAILROAD COMPANIES.—FOUNDATION PLAN FOR WESTERN AVENUE STATION.

and were to be placed in the wheel-pit 140 feet below the surface.

Mr. Sellers said the first intention was not to line the tunnel, but use the rock cut tunnel, but the great size of the tunnel and breaking away of the walls necessitated the lining of the tunnel with brick. The total number used was 16,000,000, and more than 300,000 tons of rock was removed. Mr. Sellers had made special tests as to the hardness of the brick. In these tests a sand blast was used which would cut the best of granite and glass. This test showed that the sand blast had no effect on the vitrified brick, which were not cut in the least.

The water in the tunnel moves at the rate of 26½ feet per second when 100,000 horse power is being developed. A surface canal to the river's edge which would develop the same power as the tunnel would have to be 400 feet wide and 15 feet deep. The granite opening and iron construction at the end of the tunnel was proposed by Theo. Turretini of Geneva, Switzerland. Dr. Sellers, in describing the wheels, said: "Each shaft is driven by two wheels, one above, the other below, the wheel consisting of three parts. The turbines are six feet in diameter. Outside of the wheel is a cylindrical gate. The clearance between the gate and wheel being one inch, enough water leaks through the opening to run the dynamos at the rate of 10 to 15 revolutions, so that the dynamo cannot be stopped by simply closing the gate, but some electrical or mechanical brake may be needed to bring it to rest."

Dr. Sellers compared the thrust bearing at the top of the turbine shaft to that used on a steamship. The ship being turned bow down, the propeller took the place of the dynamo, the turbine the place of the steam engine on shipboard, the thrust bearing and shaft being relatively the same.

Dr. Sellers stated that the column of water passing through the penstock was sufficient to lift the whole weight of the turbine, shaft and dynamo, 152,000 pounds, so that at no load or full load there would only be a pressure of about 3,000 pounds upon the thrust bearing. The shaft changing from one side of thrust bearing to the other at about half load, or 2,500 horse power.

Mr. Stillwell then continued the lecture, illustrating the electrical features of the plant.

He read extracts from the report of the Westinghouse company to Mr. Adams of the Cataract company. The Westinghouse Electric & Manufacturing company was required to lay out an electrical system suitable for local distribution, long-distance transmission to Buffalo and long-distance transmission beyond Buffalo, with varying units.

Given: First, four vertical shafts, direct driven by turbines making 250 revolutions per minute and capable of delivering at the top of each shaft from 5,000 to 5,500 mechanical horse power, additional turbines and shafts, to be installed as the demand for power increases; second, a market for power, beginning just outside the walls of the power house and extending at least 20 miles (and as much farther as possible), the power to be used for general industrial purposes, such as the operation of machinery in mills and factories, the operation of street railways, lighting by arc and incandescent lights, electrolytic purposes, heating.

Alternating currents would be desirable for power transmission, direct currents for electrolytic work, direct currents for street railway work and lighting by direct or alternating.

To meet all the requirements, Mr. Stillwell said that the polyphase Tesla system was decided upon, using two-phase generators with currents in two circuits differing from each other in their phase by 90 degrees. He then gave illustration by means of slides showing drawings (elevation and section) of the first generator designed for the work. This machine was for 5,000 horse power, and had a revolving armature with the exciter directly connected at the top of the shaft. The flywheel effect of this machine was too small, as the company had not been advised of the flywheel effect required, and so this type was abandoned.

Mr. Stillwell then gave an outline of the methods to be adopted for furnishing current for street railway, arc lighting, incandescent lighting, etc. He said that the frequency selected is in every respect admirable for power purposes, and was chosen in preference to a higher frequency, because the amount of energy required for lighting from Niagara will, for many years, and perhaps for all time, constitute but a comparatively small part of the energy distributed. At present the only practicable way to utilize Niagara power for lighting purposes is by substituting motors for the engines now used in arc and incandescent lighting plants in Niagara, Tonawanda, Buffalo and other cities and towns to which the circuits may be extended. When the demand for current to be used for lighting purposes becomes sufficiently important to justify a change in the apparatus, and, perhaps, in the methods now employed for lighting the cities and towns to which the circuits may be extended, a certain number of generators of higher frequency may be installed.

By a letter in 1893, by Mr. Adams, all the alternating designs were rejected and the manufacturers were asked to bid to the machines as designed by the consulting electrical

engineer, Prof. Forbes. Mr. Stillwell stated that the company refused to bid on the machines as designed by Prof. Forbes, but would it take his mechanical construction and re-design the electrical work and guarantee the machines in every respect. The Westinghouse company submitted plans for a machine, 16⅔ cycles, and another 25 cycles, and finally by letter gave reasons for advising the use of machine with 25 cycles and stating why that periodicity was thought best. The machine was of the 12-pole type, 5,000 horse power, and guaranteed to give close regulation. The speed at which the field revolves is normally 250 revolutions per minute, and the fly-wheel effect of the revolving parts of the machine, measured by the pounds multiplied by feet per second squared, is 1,274,000,000.

The height of each generator from the bottom of the bed-plate to the top of the bridge is 11 feet six inches. The diameter of the bed-plate is 14 feet, and the outside diameter of the revolving field ring is 11 feet 7⅛ inches. The armature conductors consist of copper bars 1½ inches by ⅞ inch in section, the edges of the bars being rounded to a radius of about one-eighth of an inch to avoid cutting the insulation. Two of these bars, after being insulated, are placed in each of the 187 slots around the periphery of the armature core. The conductivity of the bars used is above 100 per cent., by Matthiesen's standard. In the case of the second generator the conductivity of the copper, furnished by the Washburn & Moen Manufacturing company of Worcester, Mass., is 102.6 per cent. At the factory, the insulation of each bar was tested by applying a potential of 15,000 volts. One terminal of the transformer used in testing was connected to a layer of tin-foil, wrapped about the outside of the insulation. During the erection of the generators at Niagara the insulation was again tested by applying a potential of 6,000 volts, one terminal of the testing transformer being connected to the conductors, while the other was connected to the armature core. An alternating potential was used in both tests, and the values given are in each case the mean or effective potential. The clearance between armature and field was stated as one inch.

The ring for the revolving field, Mr. Stillwell stated, was forged in one piece.

The Bethlehem Iron company guaranteed that the rings for the first three generators should have a tensile strength of not less than 70,000 pounds per square inch, an elastic limit of 38,000 pounds per square inch, and an elongation of about 25 per cent. in two inches; but it has done much better. Three samples, cut from the first ring, were tested with the following results:

Tensile strength measured in pounds per square inch:

Sample 1—82,915 pounds per square inch.
" 2—81,110 " " " "
" 3—82,140 " " " "

Elastic limit:

Sample 1—53,560 pounds per square inch.
" 2—47,230 " " " "
" 3—49,280 " " " "

The elongation was 27.05, 27.75, and 22.5, respectively.

The method employed in balancing the revolving field is as follows: A special shaft was placed in the bearings of the machine and supported at its lower end by a thrust bearing, into which oil was pumped at a pressure of about 1,000 pounds per square inch. This pressure was sufficient to lift the weight of the revolving parts, and the collars on the shaft were separated from the grooves of the thrust bearing by a thin layer or film of oil. A small piece of tool steel was set into the upper end of the shaft, a half sphere or cup being cut in its upper surface, and into this was placed a tempered steel ball three-eighths of an inch in diameter. A large eye-bolt, with a similar piece of tool steel, having in its lower surface a cup bearing similar to that at the top of the shaft, was secured in the tapered bearing of the umbrella-shaped driver, to the periphery of which the field ring is bolted. The entire weight of the driver and the ring was thus supported upon the small steel ball.

A casting, clamped to the shaft, served to rotate the driver and ring with the shaft. The steel ball was placed a very short distance above the center of gravity of the field and driver, and under these conditions, the driver and ring being free to rock while rotated, a defect in balance was quickly shown.

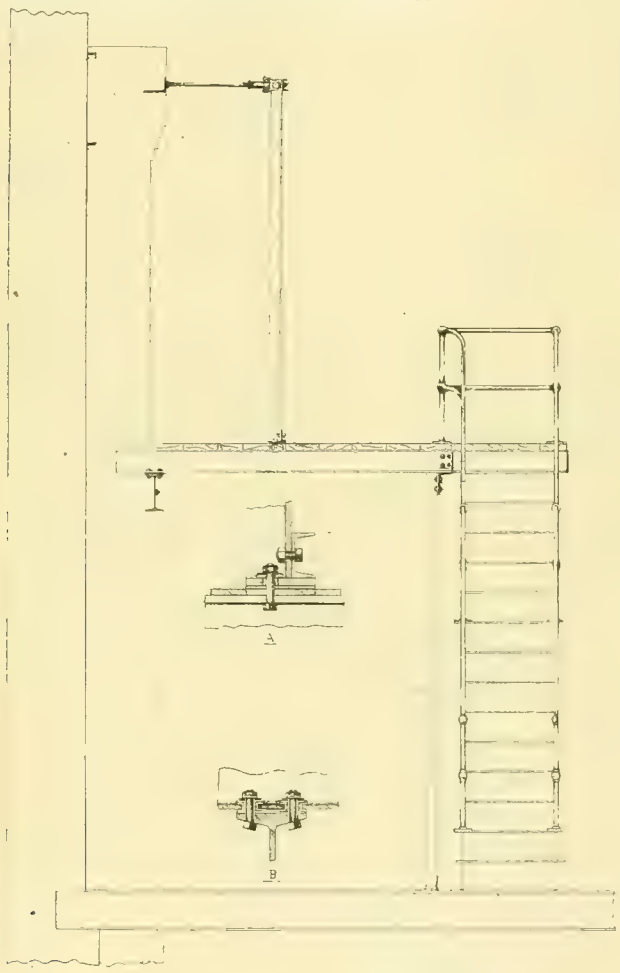



FIG. 14. SECTIONAL ELEVATION OF SWITCHBOARD FRAME.

The driver was first balanced in this manner independently. The ring was then bolted to the driver, and the two were balanced together. It was unnecessary to balance the combination of the driver, ring and field poles, since the field poles and bobbins were separately weighed, and their weights adjusted to exact equality, while the positions in which they are bolted to the ring are exactly symmetrical with reference to each other and to the axis of rotation.

Mr. Stillwell said that this method of balance was devised by Albert Smith. A speed of 150 revolutions per minute was attained on this ball.

The method of testing the magnetic qualities of the field ring was then described by Mr. Stillwell. The edge of the rough-forged ring before it was turned was tested by the permeameter method to obtain the B–H curve; that is, the ratio of induction to magnetizing force for various values of the latter. The B–H curve was also determined by a modification of the so-called "ring method," the entire field ring being used for this purpose. This very beautiful and interesting experiment was suggested by Charles F. Scott, electrician of the Westinghouse Electric & Manufacturing company, and carried out under his direction.

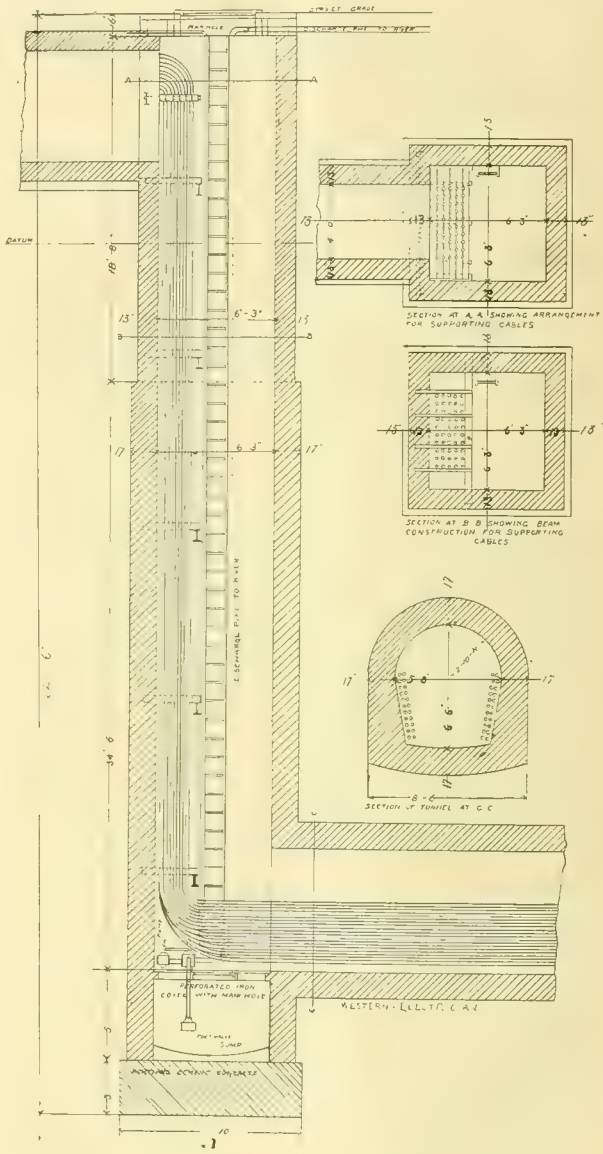
The tests by the ring method indicate higher values of the induction for moderate magnetizing forces than were obtained by the permeameter.

In case of transmission to places more remote than Buffalo, it will be necessary to adopt special means for regulating potential in the distributing mains, at least until the time when improved methods of insulating circuits shall make it practicable to employ very high potentials. When that time comes the drop in the circuits between the power house and the city of Buffalo will become so small that the Buffalos feeders may be treated as local circuits and can be supplied with current from the same bus-bars that are used in supplying power in the immediate vicinity of the power house; and when the practicability of commercially employing these very high potentials, of 25,000 or even 50,000 volts, is demonstrated, transmission to places more distant than Buffalo will be useful.

Mr. Stillwell closed by stating that the results of the test, Thursday, June 27th, were very satisfactory and that the generators were fulfilling all their expectations.

## Elevated and Underground Loops Proposed for Chicago.

The Chicago City Council has passed an ordinance giving the Northwestern Elevated road the right of way on Wells street and Fifth avenue, from Michigan to Harrison. The majority of the frontage had signed in favor of it and that part of the road between Lake and Congress is to be used in common by the Northwestern, the Lake Street Elevated, the Metropolitan and by the Alley "L" when can get over to Fifth avenue. This linking together of the several "L" roads in the city will be a great convenience to the public if it can be accomplished. The Chicago Central Sub-Railroad company is pushing its scheme for an underground loop in the down-town district. The proposition, as an open letter addressed "to the authorities and citizens of Chicago," has been printed in petition form and several copies are now being circulated among the people for signatures. Those who sign it ask the mayor and Common Council to grant an ordinance empowering this company to construct a four-track underground railroad in the down-town district of the city, and they also say they believe it to be the only correct solution of the rapid transit problem. The company says it is prepared to carry out the work of providing adequate facilities for moving the people just as soon as the council grants it a proper franchise.




THE ELECTRIC SYSTEMS OF THE NORTH AND WEST CHICAGO STREET RAILROAD COMPANIES.

FIG. 16. FEEDER TUNNEL.

## Attendance at the Institute Meeting.

Following is a list of the names of members and guests attending the Niagara Falls meeting of the American Institute of Electrical Engineers, June 25–28, 1895:

| | |
|---|---|
| Ralph W. Pope | Elizabeth, N. J. |
| W. J. Hamilton, Jr | Hackensack, N. J. |
| Alex. F Ormsbee | Brooklyn, N. Y. |
| Dr F B Crocker | New York, N. Y. |
| George H. Wheeler, Jr. | New York, N. Y. |
| George A Redman and wife | Rochester, N. Y. |
| Dr. Louis Duncan | Baltimore, Md. |
| Carl Hering | Philadelphia, Pa. |
| C. J. Reed | Philadelphia, Pa. |
| Dr Walter Lobach | New York, N. Y. |
| Prof W. A Anthony | New York, N. Y. |
| Charles S. Bradley | Avon, N. Y. |
| Charles P. Perot | Philadelphia, Pa. |
| Dr. M. I Pupin and wife | New York, N. Y. |
| Mrs. H. R Wemple | Jersey City, N. J. |
| Horace S. L. Verley | Kingston, Jamaica. |
| Charles P. Steinmetz | Schenectady, N. Y. |
| Prof J E. Davies and wife | Madison, Wis. |
| Horatio A. Foster and wife | New York, N. Y. |
| Walter M. Petty | Rutherford, N. J. |
| J G. White | Baltimore, Md. |
| J. D E Duncan | Pittsfield, Mass. |
| Harold Hakonson | Schenectady, N. Y. |
| Alex. Jay Wurts | Pittsburg, Pa. |
| L. B. Stillwell | Pittsburg, Pa. |
| D L. Goff | Rhode Island. |
| Charles F. Scott | Pittsburg, Pa. |
| E. H. Heinrichs | Pittsburg, Pa. |
| A. Fortenbaugh | Halifax, Pa. |
| C. W. Ryan | Halifax, Pa. |
| Dr. S S. Wheeler | New York, N. Y. |
| Gano S Dunn | New York, N. Y. |
| Max Osterberg | New York, N. Y. |
| Miss D. Osterberg | New York, N. Y. |
| William Brophy | Boston, Mass. |
| Geo. F. Archer | New York, N. Y. |
| B. J. Arnold | Chicago, Ill. |
| James Burke | New York, N. Y. |
| L. Knowles Perot | Philadelphia, Pa. |
| Walter E. Harrington | Philadelphia, Pa. |
| Peter Wright | Philadelphia, Pa. |
| S. B. Fortenbaugh | Madison, Wis. |
| H. D. Bayne and wife | Brooklyn, N. Y. |
| Mrs. E. Bayne | Brooklyn, N. Y. |
| W. D. Bayne | Brooklyn, N. Y. |
| Miss E. Fraser | Brooklyn, N. Y. |
| Miss G. Fraser | Brooklyn, N. Y. |
| Prof. R. B. Owens | Lincoln, Neb. |
| Frank J. Pope | Elizabeth, N. J. |
| Prof. Henry S. Carhart | Ann Arbor, Mich. |
| Harry D. Reed | Newark, N. J. |
| Elihu Thomson | Boston, Mass. |
| Geo. W. Davenport | Boston, Mass. |
| Leonard Waldo | Bridgeport, Conn. |
| H. M. Davis | Brooklyn, N. Y. |
| Nelson W. Perry and wife | New York, N. Y. |
| Miss Perry | New York, N. Y. |
| A. H. Ackermann | Brooklyn, N. Y. |
| Percival R. Moses | New York, N. Y. |
| E. J. Berg | Schenectady, N. Y. |
| Eskie Berg | Schenectady, N. Y. |
| J. B. Cornell, Jr | Hamilton, O. |
| H. Hobart Porter, Jr | New York, N. Y. |
| Dr. Chas. E. Emery | New York, N. Y. |
| Jas. S. Alden | Passaic, N. J. |
| A. D. Chandler | New York, N. Y. |
| E. N. Sanderson | Boston, Mass. |
| Geo. W. Blodgett | Boston, Mass. |
| A. M. Bleile | Columbus, O. |
| T. C. Dunlap | Columbus, O. |
| C. C. Collins | Columbus, O. |
| B. V. Swenson | Champaign, Ill. |
| James Lyman | Ithaca N. Y. |
| W. J. A. Boucher | Jersey City, N. J. |
| Chas. E. Hewitt | Ithaca, N. Y. |
| Chas. B. Hunt and wife | London, Ont. |
| Alfred Ely | New York, N. Y. |
| Ralph McNeill | New York, N. Y. |
| A. B. Weaver | Buffalo, N. Y. |
| Chas. K. Huguet | New Orleans, La. |
| Frank C. Perkins | Buffalo, N. Y. |
| Frank Bourne | New York, N. Y. |
| Geo. W. Colles, Jr | Hoboken, N. J. |
| H. G. Reist | Schenectady, N. Y. |
| Prof. B. F. Thomas | Columbus, O. |
| T. D. Boyles | Schenectady, N. Y. |
| F. C. Busch | Buffalo, N. Y. |
| R. D. McCarter, Jr | Columbus, O. |
| A. V. Abbott | Chicago. Ill. |
| Wm. J. Hammer | New York, N. Y. |
| C. R. Van Trump | Wilmington, Del. |
| D. de Lancey | Rochester, N. Y. |
| Wm. Elmer, Jr | Trenton, N. J. |
| Ed. A. Colby | Newark, N. J. |
| T. R. Roseburgh | Toronto, Ont. |
| E. B. Merrill | Toronto, Ont. |
| W. G. Fuller | Brattleboro, Vt. |
| F. Taft | Brattleboro, Vt. |
| D. N. McBrier | Erie, Pa. |
| O. B. Shallenberger | Rochester, Pa. |
| H. B. Shallenberger | Rochester, Pa. |
| M. Foltz | Buffalo, N. Y. |
| R. Pfund | New York, N. Y. |
| Wm. B. Lester | New York, N. Y. |
| Chas. A. Tinker | New York, N. Y. |
| S. R. Gifford | Syracuse, N. Y. |
| F. S. Hunting | Fort Wayne, Ind. |
| Oberlin Smith | Bridgeton, N. J. |
| H. M. Swetland | New York, N. Y. |
| P. M. Lincoln | Niagara Falls, N. Y. |
| W. A. Brackenridge | Niagara Falls, N. Y. |
| W. M. Rutherford | Toronto, Ont. |
| E. Carl Breithaupt | Berlin, Ont. |
| W. W. Nicholson | Niagara Falls, N. Y. |
| Coleman Sellers | Philadelphia, Pa. |
| Edwin R. Weeks | Kansas City, Mo. |
| Miss Ruth Weeks | Kansas City, Mo. |
| Jos. Wetzler | New York, N. Y. |
| A. B. See | Brooklyn, N. Y. |
| Wm. C. L. Eglin | Philadelphia, Pa. |
| Prof. C. F. Chandler | New York, N. Y. |
| W. W. Ker and wife | Jersey City, N. J. |
| G. H. Winslow | Pittsburg, Pa. |
| H. S. Anderson | Springfield, Mass. |
| J. W. Gilmore | New York, N. Y. |
| B. S. Lamphear | Ithaca, N. Y. |
| Harry Alexander | New York, N. Y. |
| A. V. Garratt | Boston, Mass. |
| Robert B. Mann | Milwaukee, Wis. |
| John C. Shedd | Marietta, O. |
| Prof. A. Macfarlane | Ithaca, N. Y. |
| Bert W. Douglas | Erie, Pa. |
| Henry G. Stott | Buffalo, N. Y. |
| F. M. Pike | Stowe, Vt. |
| F. Torchio and wife | New York, N. Y. |
| C. E. Gifford and wife | Jamestown, N. Y. |
| John Waring | Ovid, N. Y. |
| Geo. P. Wisdom | Chicago, Ill. |
| A. A. Dion | Ottawa, Ont. |
| Chas. I. Young | Pittsburg, Pa. |
| John L. Hall | Wilmington. Del. |
| Miss Alexander | New York, N. Y. |
| C. Thordarson | Chicago, Ill. |
| H. Foltz | Buffalo, N. Y. |
| J. W. Tillinghast | Buffalo N. Y. |
| E. F. Williams | Buffalo, N. Y. |
| H. Ward Leonard | New York, N. Y. |
| John L. Kebler | New York, N. Y. |
| Frank Brewer | New York, N. Y. |
| C. C. Burr | Niagara Falls, N. Y. |
| J. W. Rogers | Niagara Falls, N. Y. |
| C. L. Cornell and wife | Hamilton, O. |
| Fred DeLand | Chicago, Ill. |
| Jas. F Cummings | Detroit, Mich. |
| W. S. Symington | Baltimore, Md. |
| G. H. Blaxter | Pittsburg, Pa. |
| H. A. Craigin | New York, N. Y. |
| L. E. Imley | Pittsburg, Pa. |
| C. C. Wolverton | Buffalo, N. Y. |
| T. H. Yawger | Rochester, Pa. |
| M. R. Rothschild | Chicago, Ill. |
| W K. Dunlap | Pittsburg, Pa. |
| F. C. Caldwell | Columbus, O. |
| W. L. R. Emmet | Schenectady, N. Y. |
| Maurice Coster | Chicago, Ill. |
| Miss E Gumming | Philadelphia, Pa. |
| Miss Plumb | Buffalo, N. Y. |
| Chas. Plumb | Buffalo, N. Y. |
| Prof. R. A. Fessenden | Allegheny, Pa. |
| J. Jordan | Vienna, Austria. |
| R. McA. Lloyd | New York, N Y. |
| J. Martin | Newark, N. J. |
| Wm. L. Robb | Hartford, Conn. |
| Chas. R. Huntley | Buffalo, N. Y. |
| H B. Sweet | Memphis, Tenn. |
| C P. Poole and wife | New York, N. Y. |
| W. D. Weaver | New York, N. Y. |
| Jules Ueber | New York, N. Y. |
| Thos. H. Feary | Buffalo, N. Y. |
| E. P. Coleman | Decatur, Ill. |
| H. W. Fisher | Pittsburg, Pa. |
| J. R. Haskin | Niagara Falls, N. Y. |
| Stephen L. Coles | New York, N. Y. |
| Herbert Lloyd and wife | Philadelphia, Pa. |
| Miss Maud Noble | Philadelphia, Pa. |
| E. W. Rice, Jr | Schenectady, N. Y. |

## Northwestern Electrical Association.

The 1895 summer convention of the Northwestern Electrical association will be held in Chicago on the 17th, 18th and 19th of this month, and it promises to be a very successful and enthusiastic gathering. The electrical business is improving, and as the members and visitors will meet in the great summer resort of the West and enjoy a programme in which business and pleasure are intelligently commingled, they are sure to come and go in the anticipation and realization of a profitable meeting and a right good time. Active interest and a large attendance are assured.

The local committee of arrangements has been active in providing for the comfort and entertainment of the members of the association. This committee, which consists of S. F. B. Morse (chairman), A. C. Bunce, John Valentine, Chas. E. Gregory and James Wolff, has secured quarters for the meeting at the Leland Hotel at Michigan avenue and Jackson street. This hotel is pleasantly located, overlooking Lake Michigan, and the entire second floor has been reserved for the association during the convention period. The ordinary will serve as the assembly room, and the exhibits will be shown in the parlors on this floor. The committee has a special arrangement as to rates, and information on this subject can be obtained from Mr. Morse at 1014 Marquette building. The committee has outlined the following general programme:

*Wednesday, July 17th.*

9 to 12 A. M.—Business meeting.

2 P. M.—Visit the Harrison street station of the Chicago Edison company and later inspect the Metropolitan elevated electric railway.

*Thursday, July 18th.*

9 to 12 A. M.—Business meeting.

2 P. M.—Trip along the drainage canal, as far as Joliet, by special train.

8 P. M.—Theater party at the Columbia Theater; the "Merry World."

*Friday, July 19th.*

9 to 12 A. M.—Business meeting.

2 P. M.—Drive about the South Side parks and boulevards, including a visit to the old World's Fair grounds.

Secretary Goltz is busy preparing his programme of papers to be read. At present only two can be announced. One of these is by Prof. D. C. Jackson of the University of Wisconsin, who will discourse on "The Choice of Transformers," showing the advantage to be derived by testing every transformer before placing it on the line. Willis D. Jameson will read a paper on "Boiler Feed Waters: Their Treatment."

## Perry—Faulkner.

The month of June is justly considered one of the brightest in the season, but there is one happy member of the electrical fraternity who will always consider it by far the most glorious in the entire year. On Thursday evening, June 27th, Frank L. Perry, assistant business manager of the WESTERN ELECTRICIAN, was united in marriage to Miss Lucretia Faulkner, daughter of Samuel Faulkner of Chicago. The ceremony was performed by the Rev. J. H. Barrows, D.D., at the First Presbyterian church and was witnessed by many friends of the happy couple. The church had been very prettily decorated for the occasion, and there was a profusion of flowers about the chancel. After the ceremony Mr. and Mrs. Perry received the congratulations of a few friends at the home of the bride's parents, 98 Oakwood avenue. They are now enjoying an eastern trip. The newly married couple have the best wishes of a host of friends, and Mr. Perry's office associates take occasion to express their personal regard for him and their earnest wishes for the future of himself and his wife.

## Telephone Protective Association.

Before adjourning last week the Telephone Protective association completed its permanent organization, elected all of its officers and adopted a constitution. The object of the association, according to this constitution, is as follows:

(a) Mutual protection from unjust legal and other attacks by owners of alleged telephone and cognate patents tending to impair the lawful business of members of this association. (b) To discourage litigation between members of this association by providing methods of arbitration. (c) To formulate a uniform guarantee to be given by members of this association to their customers.

An important provision in the constitution relates to the defending of suits against members:

Whenever the association shall receive information of the bringing of a suit for infringement of any telephone patents, it shall at once examine into the case as far as practicable, and may call a meeting of the board of directors, who shall provide for the means to defray the expenses of such litigation as they shall deem proper under the circumstances.

The constitution also provides that "the officers shall consist of a president, first, second, third, fourth and fifth vice-presidents, secretary and treasurer, who, with 12 directors, shall constitute the board of directors, all of whom shall be elected at the annual meeting of the association." Here is the official list of officers and directors:

President, J. E. Keelyn, Western Telephone Construction company, Chicago, Ill.; first vice-president, J. R. Johnson, Viaduct Manufacturing company, Baltimore, Md.; second vice-president, S. J. Tunbridge, Utica Fire Alarm Telegraph company, Utica, N. Y.; third vice-president, E. S. Wallace, Columbia Telephone company, New York; fourth vice-president, J. G. Ihmsen, Keystone Telephone company, Pittsburg, Pa.; fifth vice-president, Lipman Levy, Anthony Telephone company, Cincinnati, O.; secretary, Paul W. Bossart, Minneapolis, Minn.; treasurer, P. C. Burns, American Electric Telephone company, Kokomo, Ind.; directors, Arthur F. Boardman, National Telephone company, Boston, Mass.; E. A. Katlin, Mason Telephone company, Richmond, Va.; P. L. Spooner, Standard Telephone & Electric company, Madison, Wis.; E. B. Seeley, E. B. Seeley & Co., Philadelphia, Pa.; Thomas McCobray, Tucker Electric Construction company, New York; —— Kuhn, Clamond Telephone company, Philadelphia, Pa.; James D. Randall, Florida Telephone & Construction company, Memphis, Tenn.; Frederic Harrington, Union Electric company, Cleveland, O.; executive committee, J. E. Keelyn, Chicago, Ill.; J. R. Johnson, Baltimore, Md.; S. J. Tunbridge, Utica, N. Y.

## Telephone News from the Northwest.

[From the Minneapolis Correspondent of the WESTERN ELECTRICIAN.]

The Western Telephone Electric company of Britt, Ia., has been incorporated with $100,000 capital stock.

Citizens of Itasca, a suburb of Superior, Wis., want telephone service.

The manager of the Central Union Telephone company, at Ottumwa, Ia., has received word from headquarters that the company will remain in business if it has to give telephones away. A new company has secured a number of the Central Union subscribers, which accounts for the notice.

It is proposed to build a telephone line from Lanesboro to Canton, Minn., via Henrytown, about 17 miles.

The Home Telephone company has begun work on a line at Montgomery, Minn.

The Phœnix Telephone company of Indianapolis, Ind., which has absorbed the Mankato, Minn., exchange proposes to run a line to Mapleton, Minn.

J. H. McCoy proposes to build a telephone line from Lansing to Waukon, Ia.

Northern Iowa is being honeycombed with long-distance telephone circuits. Lines are being built from Clear Lake through Garner, Britt, Algona, Emmettsburg and Spencer, on the Chicago, Milwaukee & St. Paul railroad.

The Northwestern Telephone Exchange is considering the advisability of extending the long-distance service from Minneapolis to Duluth.

Telephone connection has been completed between Sioux Falls and Dell Rapids, S. D.

It is proposed to connect Aberdeen, S. D., with Tacoma Park by telephone in a novel manner, connecting a wire with a track rail of the Great Northern railroad (provided the company will permit) and placing insulation in the joints at each end to prevent the current from going farther. It is said that this plan has been tried before with good results.

A telephone line is being built between Winona, Minn., and Galesville, Wis.

W. A. Cottrell of LeMars, Ia., has about completed an organization to build a telephone line from Akron, Ia., via Sioux City to Elk Point, S. D.

Stockmen on the range between Midland, S. D., and

Pierre, S. D., will build a telephone line to secure storm warnings from the weather bureau.

The Iowa Telephone company has given its 130 subscribers at Oskaloosa, Ia., free telephone service until further notice. A local company has just begun operating its exchange with 400 subscribers, most of whom were formerly patrons of the Iowa company.

## New Telephone Enterprises.

One result of the recent conference of telephone companies at Pittsburg is the growing confidence of anti-Bell concerns in their ability to hold their share of the business. Several instances in which improvement in public confidence has been shown are disclosed in reports received from numerous points during the week. A dispatch from Pittsburg announces that that city is to have an independent telephone system and cheaper rates, in competition with the Central District Printing Telegraph company, a Bell concern. It is proposed to be furnished within a year by the Electric Messenger company of Pittsburg, which is chartered and has a capital stock of $500,000. Local and eastern capital is interested, as well as Congressman Thomas L. Johnson of Ohio. The already completed independent exchange at Johnstown will be connected, the system extended throughout the towns and counties of Western Pennsylvania, and its main lines run to Cleveland and Chicago on the west and Philadelphia and New York on the east. Work on the conduits in Lower Pittsburg will begin in July. The local rates will probably not exceed $45 or $50, instead of the $84 and $120 Bell rates. Representative William T. Marshall, J. N. Pew, president of the People's Natural Gas company, Thomas Bigelow and others are among its directors. Its organization received impetus, it is said, by the recent organization of the Telephone Protective association and the individual efforts of J. E. Keelyn of Chicago, the president of that association.

Concerning the experience of the new company at Johnstown, a dispatch dated June 26th says: "In this city the new telephone exchange recently established in opposition to the Bell company is increasing with unexpected rapidity, showing the value of low rates and modern improved service. Another lot of 100 telephones has just been received from the Western Telephone Construction company of Chicago, which, together with the additional switchboard, is being placed in use. The Bell company told the Johnstown people that a $50 telephone rate did not pay 6 per cent. on the investment. The new company made a low rate of $24 per annum for residence telephones, and $30 yearly for business houses. Information from a reliable source indicates that a good and satisfactory profit is earned at these rates, and the subscribers say the service is far ahead of the Bell. The old Bell subscribers have almost entirely gone to the new company."

War to the death has been declared by the Iowa Telephone company, which, June 21st, issued an order giving its 300 subscribers at Oskaloosa free rental until further notice. The order was issued just as the new local company was ready to open its exchange with a list of 400 subscribers, most of whom have heretofore been subscribers to the old company.

From Upper Sandusky, O., comes the interesting news that the local telephone plant is almost ready to begin operation. The Central Union company has a plant there, but, it is added, the subscribers have all gone over to the new company, which will charge only $24 per year for commercial service and $12 for residences.

The Astoria Telephone company, with a capital stock of $25,000, was incorporated at Astoria, Ill., on June 26th. The company is composed of prominent business men of Astoria, who propose to operate a telephone system throughout central Illinois. The line already connects twenty Fulton county towns, and the system will soon be extended to other counties.

The Washington, D. C., correspondent of the WESTERN ELECTRICIAN says: "The Baltimore & Washington Standard Telephone company is now an assured reality, and canvassers will begin work among the citizens of Washington at once to secure subscribers. Many prominent professional and business men have signified their intention to take telephones, and it is thought no difficulty will be experienced in obtaining a great number of subscribers in a short time. The rates charged are very low, and are not one-half those now paid. A large amount of Washington capital is invested in the company, and on this account some local pride is felt in the venture. The directors are L. G. Hine, E. S. Johnson, Frank Humes and Theodore J. Mayer of Washington; George W. Cross, Gen. Felix Agnus and J. W. Woodland of Baltimore; J. C. Robertson of Richmond, and A. T. Nye of New York. George W. Cross, an able and efficient business man, will be general manager of the company, and he has secured offices in the McGill building, on G street, near Ninth."

## Chicago Officials Charged with Favoring the Bell Company.

A well-informed Chicago gentleman makes the following charges of favoritism against city officials in a communication to a daily paper:

The Chicago Telephone company not only refuses to give reasonable reduction in rates to subscribers, but it makes every effort to prevent subscribers from getting service at a low rate from other directions. In a number of cases in which telephones were furnished to business houses in the city of Chicago, an arrangement between the city electrician, John P. Barrett's office, and the Chicago Telephone company's employes, has resulted in their cutting these wires down. The people are afraid to buy telephones for their own use for fear of being hampered in their use. Such concerns as Carson, Pirie, Scott & Co. and others who had purchased telephones and built their own lines, found that through the orders of Chief Electrician Barrett these wires were cut down and carted off in the Chicago Telephone company's wagon. This occurred notwithstanding the fact that the Chicago Telephone company is daily putting up wires in like manner with the knowledge of the city electrician. A line of new poles carrying an immense number of overhead wires has just been built on Clinton street, contrary to the ordinance. It seems strange that the city electrician cannot discover this immense public violation of the ordinance, but can find time to slip into out-of-the-way alleys to harass business men and private parties who are endeavoring to furnish their own telephone service without tribute to the general monopoly.

## Exhibition of Telephone Apparatus.

An event of the week was an exhibition on Wednesday, June 26th, of a complete non-infringing system for telephone exchanges by the United States Telephone Construction company of Philadelphia, general agent for the M. & B. telephones. A. H. Chadbourne, the general manager of the company, afforded visitors every opportunity to inspect and test the devices on hand. It was a very interesting exhibition, and was in the nature of an educational movement in many ways.

## Whitmore-Dean Electric Feed-water Purifier.

The Whitmore-Dean automatic electro-feed-water purifier, which has been used with very satisfactory results on

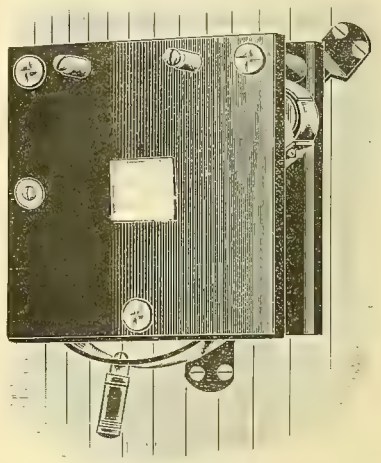
WHITMORE DEAN ELECTRIC FEED-WATER PURIFIER.

the boilers of the Roscoe boulevard plant of the Chicago Electric Transit company, described in this issue, is being adopted in many of the best and largest modern plants. This device is used for the purpose of preventing the formation of scale in steam boilers. It is distinct and separate from, and is an essential supplement to, the feed-water heater, and is located at some point in the line of the feed pipe between the heater and the boiler. It is attached to the feed pipe and forms a part of it. It has no electrical or other connections aside from the feed pipe, and is wholly self-contained. The mechanism of this device is exceedingly simple, as will be seen from the cut here shown, and consists in an iron cylinder containing a series of electro-positive and electro-negative plates having a water passage through and around them. The action of the device is said to be as follows: The feed water in passing through the purifier comes in contact with, and is subject to, the action of these positive and negative plates, the result being that the affinity which exists between the particles in the water which ordinarily form a scale is destroyed, so that they cannot combine, but pass on into the boiler in a separated state and remain so, until washed out when the boiler is cleaned or is blown off. The advantages of such a device will be readily recognized by anyone using steam boilers.

## Novel Rheostat.

Motor-starting rheostats have become very important features in the electrical line, as the Board of Underwriters as well as city fire inspectors not only require their use wherever motors are used, but stipulate they shall be made to open the motor circuit automatically and be fireproof. It is also required that a double-pole switch be placed between the main wires and the rheostat, and that this switch must always be opened after the motor is stopped to avoid the danger of fires from grounds, lightning and the like. This latter requirement has resulted in more or less disaster and annoyance, as the error is frequently made of closing the armature circuit before closing the switch or field circuit. Thus the full force of the current is suddenly thrown on the motor. Such mistakes result in the instantaneous short-circuiting of the system and blowing of the fuses at the power station, as they may be already loaded nearly to their full capacity, thereby temporarily disabling the entire system.

A device has been invented by John C. Fyfe of Chicago to meet the requirements of the underwriters and comply

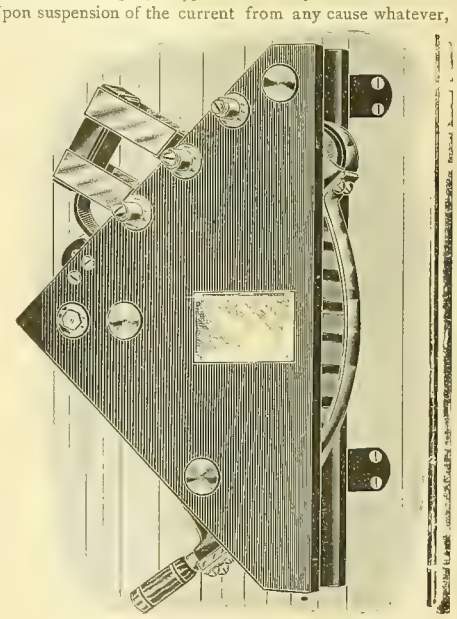


NOVEL RHEOSTAT.

with the city inspection rules, at the same time obviating the possibility of such mistakes as those heretofore alluded to. This device is shown in the accompanying cuts. It is manufactured by the Hayes-Fyfe company, whose headquarters are at 1006 Pontiac building, Chicago.

The primary object of the Fyfe motor-starting rheostat is to overcome the objectionable features referred to, and this is accomplished by providing a double-pole switch through which the circuit must be closed before the resistance and armature circuit can be closed.

The revolutionizing feature of this improvement, however, lies in its being automatic in its release from any point of contact of the resistance, and the contacts being of iron, of great surface, are magnetized by being wound with the resistance itself. The resistance is insulated by an absolutely fireproof porous insulation, and is consequently perfectly ventilated but rigidly supported in every turn of the coils. Upon suspension of the current from any cause whatever,



NOVEL RHEOSTAT.

the multiplicity of rolling iron contact disks, carried by the contact arm at any point where they have been allowed to remain, become instantly released and fall by their own weight, not only opening the armature circuit but positively forcing open the double-pole switch after the initial magnetic resistance contact has been passed.

It will thus be seen that the motor may be operated at any required speed or power, and be automatic in release from that point. The supporting of the fireproof ventilating resistance and the working parts within plates of slate, which are supported by thoroughly insulated iron feet, is sufficient proof of safety in operation. The liablity to wear of the wearing parts of the device is reduced to a minimum.

Mr. Fyfe, the inventor, is well known in electrical circles, having been engaged for the last fourteen years in practical experience in the art.

## Lenox Avenue Electric Conduit Road.

The electrical underground conduit railway now in operation in New York will shortly be connected to the great cable traction system of the Metropolitan Traction company, by which the public will be enabled to travel from the Battery to One Hundred and Forty-sixth street, with one transfer, from the cable car to the electric car, at West One Hundred and Eighth street. The Lenox avenue line is a double track road, starting at the car house at One Hundred and Forty-sixth street and running directly south to One Hundred and Sixteenth street, into which it turns and proceeds as far west as Manhattan avenue, where it turns and runs as far south as One Hundred and Eighth street, along which it is carried to the junction of that street and Columbus avenue. The power house, an interior view of which is shown in Fig. 1, is a temporary frame structure with a sheathing of corrugated sheet iron, located on One Hundred and Forty-sixth street, a few yards west of Lenox avenue. The present power plant consists of two 650 horse power engines and two 400 kilowatt generators. Steam is supplied from two Babcock & Wilcox water-tube boilers, arranged in one battery. Each has a rated capacity of 250 horse power, furnishing steam at 120 pounds.

The engines are horizontal cross-compound Allis Corliss machines, which, during the experimental trips, will run non-condensing. All the steam piping is placed beneath

FIG. 4. LENOX AVENUE ELECTRIC CONDUIT ROAD.

the floor of the engine room. To each of the engines is coupled a General Electric 400 kilowatt generator of standard construction, but wound for 350 volts instead of 500 volts, as is the usual practice in railway work. This machine is placed between the high and low pressure sides of the engines.

From the generators the cables run beneath the switchboard to a subway under the sidewalk on One Hundred and Forty-sixth street, extending as far as Lenox avenue, where they are introduced into the five-inch iron pipes running parallel with the conduit. For the present the line will be operated directly from the power house, but the feed wires will probably be placed in the pipes and will be tapped into the conductor at the necessary points. This line will then be divided up into sections and its general operation greatly facilitated.

In the construction of the underground contact system the plow is suspended from the car truck. Passing through the slot in the center of the track it presses against the flat surfaces of two iron conductors running the entire length of the conduit. These conductors are placed each three inches on each side away from the center of the slot to avoid deleterious effects of any drip which would otherwise reach them, and are of channel iron four inches deep and 30 feet long. They are suspended from the ceiling of the conduit, as shown in Fig. 2, by means of insulators devised for this especial purpose, and are at a depth of 13 inches below the conduit slot. Each conductor is sufficiently rigid to require suspension at the ends and centers only, and the ends being located in the manholes, and handholes being placed at the centers, inspection and repair are rendered comparatively easy. The conductors are bonded to each other by stranded copper wire securely riveted into the web of the metal.

A modification of this system of suspension of the conductors is introduced for a length of about 100 yards of single track on One Hundred and Sixteenth street between Lenox and Seventh avenues. This is known as the pedestal method of support and is illustrated in Fig. 3. At the manholes, instead of insulators suspended from the ceiling of the conduit, the conductors are supported by a soapstone pillar. The channel bar conductors in this case are five inches deep and are set 12 inches below the slot. The soapstone pillars are provided with iron caps furnished with brackets to which the conductors are bolted, and continuous connection is secured by means of a bend of flat copper strips riveted

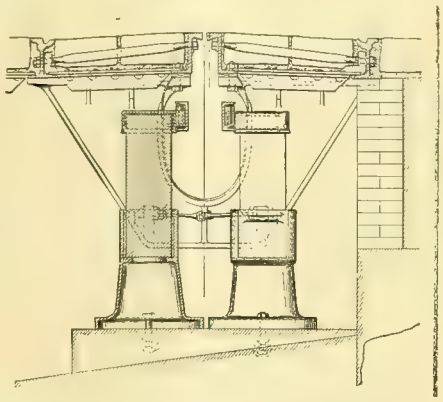


FIG. 3. LENOX AVENUE ELECTRIC CONDUIT ROAD.

to the webs. The soapstone blocks are set in iron cases erected in the manholes.

Every twelfth man-hole is connected with the power house by telephone. Quick-break switches are located at intervals in these manholes, in order that any section of the line may be cut out in case of trouble or accident. At the track switches each conductor is provided with a flaring nose to facilitate the entrance of the plow into the conductors. The manholes in which the insulators are placed are four feet four inches in depth, four feet in length and 14 feet 5½ inches in width, that is, the entire distance of the two tracks. They are constructed of brick with eight-inch walls that rest on concrete foundations. The floors are laid with six inches of concrete and are provided with drains for carrying off water. With this provision for drainage no trouble from water in the conduit will, it is believed, be experienced. The conduit was built along the grade of the street, but with sufficient pitch to permit any water flowing into the conduit to find its way into the manholes, located every 30 feet, and from thence into the sewers.

The current does not return by means of the rails, as is usually the case with the overhead trolley. Each conductor forms one side of the working circuit; the current is fed into the positive conductor and returns over the other or negative conductor. The current merely rises on one side of the plow, passes through the controllers into the motors, and after performing its duty returns by the other side to the opposite or negative conductor.

The plow or traveling contact arrangement is also essentially novel. As shown in Fig. 4, it consists of two pieces of iron, one on each side of the plough, supported on spring leaves, which causes them to press outwardly against the two conductors. The plow is suspended from a longitudinal bar bolted to cross-beams set upon the truck, and is constructed of two sheets of steel, laid each one upon a plate of fiber. The two sheets of fiber are then brought together, enclosing strip copper conductors connected at the top to the motor cables, and at the bottom riveted to two other pieces of sheet steel. These run on each side of the plow and serve as supports for the hinges which carry the sliding contact pieces. A heavy sheet of fiber continues downward and serves to separate these contacts.

The motors employed are the standard General Electric 800 machines, controlled by K2 controllers.

The cars which are to be used on the line were constructed by the John Stephenson company and are mounted on standard cable trucks constructed by the Peckham Motor Truck & Wheel company. They resemble those used on the Broadway line. The cars are to be lighted by nine incandescent lamps arranged in groups of three each. A car barn similar in construction to the power house has been built at the corner of One Hundred and Forty-sixth street and Lenox avenue. The building is provided with four tracks and has a storage capacity for about 20 cars. The tracks are provided with pits for the examination of the trolleys and motors.

## Proposed Clark Street Trolley Line in Chicago.

A strenuous effort is being made to introduce the overhead trolley system into the business center of Chicago by

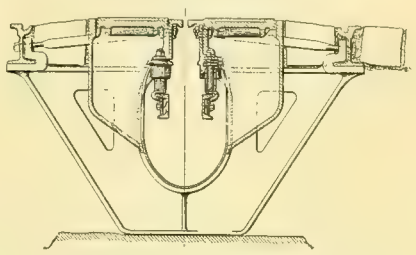


FIG. 2. LENOX AVENUE ELECTRIC CONDUIT ROAD.

way of Clark street to the intersection of Washington street. This would give the Chicago City Railway company a third trunk line into the heart of the city from the South Side. Many property owners in Englewood and the down-town district favor the scheme, but others are bitterly opposed. One advocate of the improvement asserts that the electric line would build up legitimate business on South Clark street and drive out the low resorts which, from Harrison to Twelfth streets, have made the street notorious for degradation and vice. Mayor Swift is believed to be opposed to the plan. He asserts that the street car companies can operate electric cars from buried conductors in down-town streets if they are willing to bear the expense.

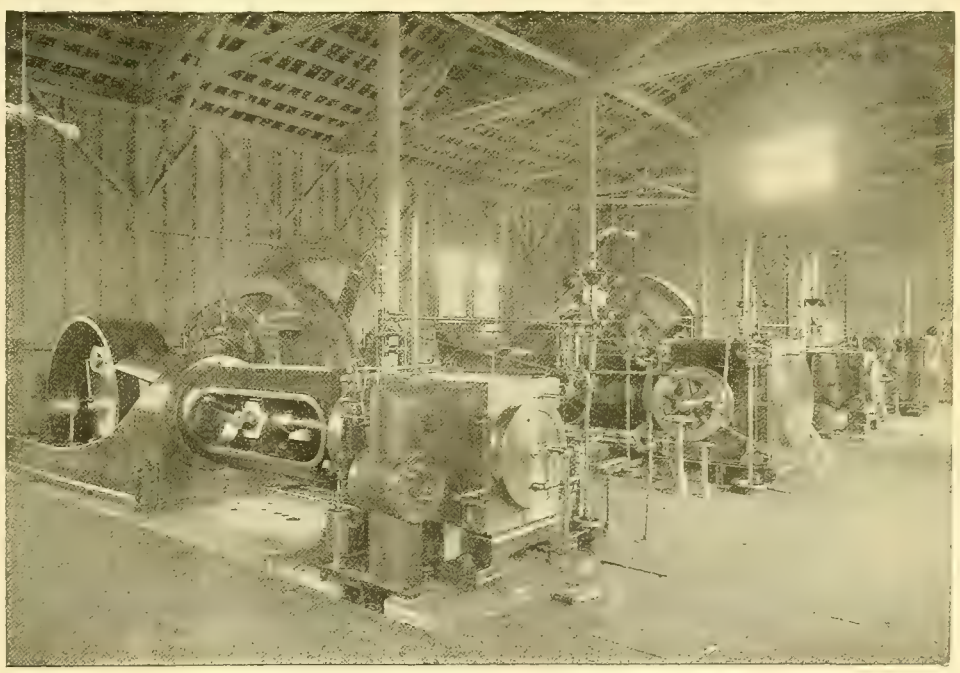


FIG. 1. LENOX AVENUE ELECTRIC CONDUIT ROAD.

The trustees of Syracuse University have made provision for the enlargement of the electrical and mechanical engineering plants.

## Electricity on the Elevated Railroads of Chicago.

The record made by the Intramural railway at the World's Fair in 1893 has evidently been carefully analyzed by corporations in Chicago and New York operating elevated railways. The first substantial evidence given to the world that the Intramural was the complete success that its promoters represented was the contract closed by the West Side Construction company, representing the Metropolitan Elevated of Chicago, in June, 1894. This installation having been completed and operating commercially for something over two months, a more tangible opportunity, perhaps, was afforded those interested in ascertaining the true merits of the electric system as compared with steam in the operation of elevated railway trains, independent of the reports given out by the General Electric company, covering the confidential details of the operation of the Intramural railway. It must be taken for granted that the investigation has fully borne out all the claims of the General Electric company as to the performance of electrical apparatus designed especially for elevated railways, as the Lake Street Elevated Railroad company has just closed a contract with that company for the complete displacement of its steam locomotives, and the trains on the Lake street "L" will, in three months from this date, or perhaps less, be propelled exclusively by electricity, and the steam locomotives will be relegated to some other duty.

The present contract with the Lake Street "L," as entered into with the General Electric company, covers the delivery at an early date of complete electrical equipments for 25 motor cars. The equipment will, in the main, be like that furnished by the General Electric company to the Metropolitan Elevated, consisting of two G E 2,000 motors for each motor car, with its complement of series parallel controllers, air pumps, electric lights, etc. The maximum duty required of the motor cars will be the carrying of three trailers during the busy hours of the day, with two trailers during the light hours, making a maximum speed of about 30 miles per hour. The total cost of the new equipment, including the necessary changes in structure and rolling stock, is estimated to be $200,000. Current will be obtained from the Western avenue plant of the West Chicago Street Railroad company, described at length in this issue, at 10 per cent. above the cost of production.

The closing of this deal may be taken as foreshadowing the ultimate conversion to electric power of all elevated roads in the country. The Alley "L," Chicago, will be the next to fall in line, though its depleted treasury may postpone the change for many months. It has been decided to equip the Northwestern "L" with electricity, and the possibility of running the Illinois Central suburban trains by the same motive power is being discussed. The Manhattan "L" people of New York are figuring on the conversion of that system, and it is said that their chief engineer was in Chicago three weeks ago making an investigation of the cost of operating the Metropolitan. The books of the company were placed at his disposal.

There has been much speculation in Chicago as to the saving in operating expenses effected by the use of electricity on the Metropolitan. The officials have steadily refused to make the information public, but a portion of the findings of the Manhattan engineer were learned yesterday, says the *Chicago Times-Herald* of June 29th. In the matter of saving fuel the result is astonishing. At the time he made his investigation the Metropolitan was running 12 trains, averaging four cars each. The fuel bill was $40 a day. For the performance of a like service by steam locomotives on the Manhattan road he figured the cost at $200. Since the engineer's visit the Metropolitan has opened its Garfield Park line and is running 24 trains, the fuel bill now being $50 a day. It is stated that the small increase in the fuel is due to the increased efficiency of the power plant. Another saving is in help. Locomotive engineers on elevated roads average $4.50 a day, while the fireman gets $2.50, making $7 a day for engineer and fireman. A motorman, who takes the place of both, gets at the outside $2.50 a day, thus saving about $5 a day for each train, or $100 a day in running 24 trains.

## Ask to Have Wires Placed Underground.

Last week a delegation from the West Side Business Men's association, Chicago, waited upon Commissioner of Public Works Kent and requested that some action should be taken to compel the telegraph and telephone companies on South Halsted street to place their wires underground. The question has been agitated by the association for some time. Commissioner Kent told the delegation he would have the ordinances examined under which the companies were operating, and would then take the matter under consideration.

# MUNICIPAL LIGHTING.

## What About Cash?

[From the *Chicago Chronicle.*]

Extension of the municipal electric lighting plant, either by the purchase of systems now owned by private companies or by building on to the present system owned by the city, is not practicable. Discussion of it can lead to nothing unless a clear idea of where the money is to come from is first obtained. The mayor and comptroller may know of some fund from which $75,000 or $100,000 may be taken for this purpose, but if they do the great body of taxpayers will be wonderfully amazed. It is not many days since these officials were bewailing he fact that the city was heavily in debt, had reached the limit of its bonded indebtedness and was compelled to resort to the most ignoble devices to keep its creditors quiet. Under such a condition—and it is a matter of common notoriety that the condition exists—talk about heavy expenditures for the purchase or construction of a municipal electric lighting plant is the purest buncombe.

The most forcible argument against public ownership of railroads, telegraphs, street railroads, gas and electric light works and telephones is that the standard of integrity among men serving the public in political posts is so low that they could not safely be intrusted with the management of such great properties. There is a measure of justice in the plea.

## Taxpayers Must Foot the Bills.

[From the Springfield, Mo., *Republican.*]

If you believe the city can operate an electric light plant without paying interest on the money it costs to build it, and without any depreciation of the plant through the wear and tear of machinery and equipment, then you will believe the figures printed in the little dodger. If on the contrary you believe the city will have to pay interest on its debt, and will have to make good the depreciation of the plant, then you will believe the figures printed in the *Republican*, partly presented by itself and partly by Councilman Porter. In the first case you will probably vote for the bonds. In the latter you will certainly vote against them.

## Electric Power for the Chicago Suburban Lines of the Northern Pacific Railroad.

It is announced that electric power will be substituted for steam locomotives on the Chicago suburban lines of the Northern Pacific Railroad company, if the necessary consents can be obtained. The lines which will be affected by the change are the Chicago, Harlem and Batavia, the old narrow gauge; the Chicago and Southwestern, which connects with the main line at Oak Park and has its western terminus at Harlem avenue, and the Chicago Central, which leaves the main line at Western avenue and runs to Blue Island and Harvey. The total length of these branch lines is in the neighborhood of 35 miles. "We have," said General Manager Ainslie in an interview, "a large equipment of coaches, the majority of them adapted to the electric system. With our heavy rails and good double-truck cars we will be able to give a smooth, quick means of transportation much in advance of the steam service. A great part of our lines run through fine residence property, and the abolition of the smoke nuisance will be welcomed by people in the suburbs. I cannot say what the change will cost; the engineers are still at work on that problem. The power will be ready as soon as the alterations in the tracks are completed. We will use the overhead trolley system. The company already has a large electrical power plant at the Grand Central station, which works the interlocking switches for five miles, and buildings at Robey street, which are available for further power. There are other plans in regard to power of which I am not prepared to talk at present."

## Natural Gas Explosion in a Chicago Central Station.

An explosion of natural gas occurred at the North Side station of the Chicago Edison company at North Clark and Oak streets on Saturday evening, by which a Heine boiler in the eastern battery was considerably damaged. The accident resulted in the injury of two employes and the shutting off of the lights dependent on the station from eight o'clock until midnight. The cause of the explosion is unknown. The noise was deafening, and people in the vicinity were greatly frightened. Engineer David Jenkins was at his post when the explosion occurred and he was almost stunned. Then, suddenly recovering his senses, he felt his way over red-hot bricks and through clouds of steam to the place beneath the sidewalk where the natural gas supply valve is located. Here he shut off the gas, thus preventing the danger of a second explosion, under the other boiler. Jenkins was badly burned and scalded, and, together with Fireman Peter Brennan, who also was burned and scalded, was taken to the Chicago Polyclinic Hospital. The fire was easily extinguished. The North Side plant is new, having been in operation less than two years, and is considered a model installation. Natural gas is used for fuel in summer, when the supply is ample. The accident appears to have been unavoidable, but it may have some effect in discrediting the use of natural gas in power stations.

## Fenders for Philadelphia Trolleys.

An ordinance of Philadelphia's councils requiring all trolley cars in that city to be equipped with efficient fenders took effect on Tuesday of last week, and the Philadelphia papers state that fendersare being rapidly placed on the cars. The ordinance says:

It shall be unlawful for any passenger railway company propelling its cars by electricity to run the same through the streets or avenues of the city unless each car is provided with a safety guard or fender, constructed in such a way as to protect life and limb of any person who may come in contact with said car.

Heavy penalties are imposed for any failure to comply with the law.

A New York contemporary commenting upon this subject says: "It is inexplicable that Philadelphia, Baltimore and Washington should have made this great reform, while the municipal authorities of Brooklyn have so far failed to protect the people from slaughter by the trolleys of that city. The Brooklyn trolleys are to all intents and purposes fenderless, or worse than fenderless, and human life is hourly imperilled. Some weeks ago the number of persons killed by the Brooklyn trolleys was 108 or 110, not to mention the much larger number injured or maimed for life. One would suppose that the authorities of a Dahomey or an Ashantee village would take steps to prevent such slaughter in their streets. But the present Brooklyn city government seems entirely indifferent to Mayor Schieren's plea for legislation making the use of efficient fenders compulsory on the car companies."

## Successful Test of the Electric Locomotive at Baltimore.

The following dispatch from Baltimore describes the experiment on June 27th in that city: "The big electric locomotive which will pull Baltimore & Ohio trains through the Belt line tunnel was sent through the tunnel this afternoon by electricity, the test being very successful. Four trips were made without any delay. No effort at speeding was attempted, but it is thought the engine can easily run fifty miles an hour. The contract calls for at least thirty miles. The new motor will probably be put into regular service on Monday next."

## Power Transmission Project at Fresno, Cal.

The contract for the apparatus for the power transmission plant at Fresno, Cal., has been awarded the General Electric company. Three 300 kilowatt generators will be installed. Current will be transmitted 31 miles. The pressure adopted is 10,000 volts. Work has already been begun at the Schenectady works on the apparatus for this plant.

# CORRESPONDENCE.

## New York Notes.

NEW YORK, June 29.—The reorganization committee of the Long Island Traction company has adopted a plan of reorganization, to be submitted to the stockholders. The plan provides for the creation of a new company under the laws of the state of New York, to be known as the Brooklyn Rapid Transit company, to assume the liabilities and acquire the assets of the old Long Island Traction company. The new company will have a capital stock of $20,000,000 and will be allowed to issue 5 per cent. fifty-year gold bonds to an amount not exceeding $7,000,000. Arrangements are made for the retirement of the outstanding collateral trust notes and the other indebtedness of the Traction company, and ample provision is made for putting the railroad property at once in first-class condition. About $2,000,000 of bonds will remain unissued until future requirements of the road shall make their issue necessary. It is stated that Clinton L. Rossiter will succeed Mr. Lewis as president of the reorganized company.

Ex-Congressman Amos J. Cummings, the last of the important hold-over Tammany officials, was removed from his position as subway commissioner on Thursday and Thomas L. Hamilton, a Platt man, appointed in his stead. The salary is $5,000. Mayor Strong is reported to have said, while discusssing the passing of Commissioner Cummings, for whom he has a sincere liking personally, that he is in favor of the abolishing of the subway commission because it is a sort of fifth wheel to the city and can, in his opinion, be dispensed with.

Romaine Callender's automatic telephone exchange system, described in the WESTERN ELECTRICIAN several months ago, is now on exhibition in Mr. Callender's laboratory in the Decker building, Union square. The inventor hopes to form a stock company.

The young women operators at the Boerum street exchange of the New York & New Jersey Telephone company are talking about the approaching marriage of Miss Mamie Carroll to Harper Jaunakey, a travelling salesman, their love-making, it is alleged, having been carried on over the telephone.

A series of tests was made last week at Fort Hamilton to determine the value in conditions of actual practice of Lieut. Bradley Fiske's electrical position finder. The device is intended to plot upon a chart the position of objects both at rest and in motion, and the test undertaken by the ordnance board consisted of making estimates by these instruments of the range and direction of various objects, and comparing them with a known standard. The Fiske position finder consists of two telescopes placed at the opposite ends of a base line, which may be, according to circumstances, from 100 yards to a mile or more. Each telescope is fitted with contacts upon arcs of electrical resistance, and these resistances are electrically connected. The operator simply directs the telescope to the target, while a third man, stationed near one of the instruments, moves a pointer in such a way as to keep a galvanometer connected with the circuit always pointed to zero. When this is done the pointer is parallel to the telescope at the other end of the base line. The position of the target on the chart must then be somewhere along this pointer. Another pointer is actuated by the movement of the other telescope, so that the position of the target on the chart must be also somewhere along the second pointer. The required position, therefore, must be at the intersection of these lines. This point of intersection is instantly communicated to the guns electrically. It is believed that the outcome of the tests will be far within the margin of error allowed.

Lightning struck the cable duct on One Hundredth and Twenty-fifth street on the afternoon of the 24th instant, and pedestrians saw a fine display. The electricity ran along the slot between Fifth and Lenox avenues for 125 feet. Then it made a sudden dive and emerged again between Lenox and Seventh avenues. Here it ran along, a dazzlingly bright blue flame, for 200 or 250 feet. A horse standing in front of the Star Laundry on One Hundred and Twenty-fifth street, near Lenox avenue, received a shock. He wobbled on his legs for a moment or two, and then regained his equilibrium. He was unhurt. The gripmen on the One Hundred and Twenty-fifth street line, as far as Ninth avenue, felt a distinct electric shock.

It is stated that nearly a score of Roman Catholic churches in this city are electrically lighted, the latest to be thus equipped being the little church of St. Anne, in East Seventy-fourth street. W. F. O.

## Northwestern Notations.

MINNEAPOLIS, June 29.—The Cascade Electric Light & Power Company of Cascade, Ia., has been incorporated with $7,000 capital stock.

There is considerable sentiment in Logan, Ia., in favor of electric lights.

W. B. Potter & Co., owning electric light plants at Mellette and Beresford, S. D., have dissolved, and the Northern Waterworks & Power company succeeds them.

Prof. G. D. Shepardson, of the University of Minnesota has drawn plans for the Willmar, Minn., electric light plant.

Ex-Senator Peterson has secured a verdict for $5,200 damages against the Western Union Telegraph company at New Ulm, Minn., for transmitting an alleged libellous message. This the second trial, the first resulting in damages for $10,000. The message was anonymous and was sent at the time of the Davis-Sabin senatorial fight, in which Peterson displeased some of his constituents by his voting.

A citizen of Iowa Falls, Ia., proposes to bond the town for $25,000 to build an electric line.

Sleepy Eye, Minn., will soon build another electric light plant to replace the one destroyed by fire.

An electric line between Saratoga, Wyo., and Wolcott station, about 22 miles, is proposed. Power from the Platte river would be utilized.

The Manitowoc, Wis., council is conferring with John Schuette with a view to buying the electric light plant.

The ordinance committee of the Mankato, Minn., council reported the ordinance for the Siemens & Halske Electric company unfavorably.

The Mason City Electric company of Mason City, Ia., is building an enlargement.

Robert Strachan has a franchise for an electric light plant at St. Thomas, N. D.

O. H. Simonds is negotiating to arrange a reorganization of the Great Western Manufacturing company of Duluth, Minn. The plan of reorganization is not made public, but is understood the claims of the creditors will be represented by shareholdings in the new company. Considerable new capital will be put in and the works put on a more substantial basis than ever before. M.

## PERSONAL.

Prof. Thomas Henry Huxley, the noted English scientist, died in London on June 29th.

William H. Bryan of St. Louis, while in Chicago on Saturday last, took occasion to visit several large electrical installations.

The emperor of Germany has granted a pension of $100 a year to Miss Reis, the daughter of Philip Reis, who, Germans assert, was the real inventor of the telephone.

John H. Poole, general manager of the Denver Consolidated Electric company, is in Chicago looking up the question of purchasing apparatus for the Denver plant and for a new station in Leadville.

Max A. Berg, secretary of the Wallace Electric company of Chicago, resigned his position as an officer of that company on July 1st. Mr. Berg will take a well earned rest, and, no doubt, will become associated with the electrical industries again in the future.

Secretary and Treasurer A. C. Garrison, of the Columbia Incandescent Lamp company of St. Louis, visited the office of the WESTERN ELECTRICIAN last week in company with Manager Joseph M. Hill of the Chicago office of the Columbia company. Mr. Garrison only spent the day in Chicago, returning to St. Louis in the evening.

M. O'Dea, professor of electrical engineering of the University of Notre Dame, passed through Chicago last week on his way to California, where he goes to enjoy a well earned vacation—the first in 14 years. Mr. O'Dea is justly recognized as one of the veterans of the electrical fraternity, having entered it about 25 years ago. He has seen the industry grow to its present proportion, and was associated with old electrical companies which have long since been forgotten. He has been connected with electrical engineering projects in 29 states and of late years has devoted himself to the interests of Notre Dame University, where his ability has won him many friends. The position of this school among the institutions teaching electrical engineering is due largely to Mr. O'Dea's indefatigable work. Mr. O'Dea will remain about a year in California and will visit the principal electrical installations on the coast.

## NEW INCORPORATIONS.

Electric Wire Hanging Insulator company, Chisago; capital stock, $200,000; Edgar O. Baker.

The Chenoa Electric Light & Power company, Chenoa, Ill.; capital stock, $45,000; Henry Hope.

Plainfield Electric Light & Power company, Plainfield, Ill.; capital stock, $4,500; Gilas D. Foster.

Goam Electric company, Chicago; capital stock, $10,000,000; to manufacture electrical apparatus; Bassett Cadwallader.

## ELECTRIC LIGHTING.

Congressman J. Frank Aldrich and F. W. Horne of Chicago have secured ordinances permitting them to operate gas and electric light plants in Peoria.

An electric light plant equipment is to be installed in the Government Hospital for the Insane, near Washington, D. C., and sealed proposals, in duplicate, will be received at the Department of the Interior until 2 P. M. on July 22d. The specifications may be had on application to the department. They provide for two plants, on the three-wire system, each consisting of a compound engine and two 125 volt direct current dynamos. The engines are to be of 200 and 100 horse power respectively, and the dynamo pairs are to have a capacity of 1,000 amperes and 500 amperes. The units may be directly connected or rope driven, and Armington & Sims engines and Edison dynamos are mentioned as standards.

## ELECTRIC RAILWAYS.

At the meeting of the Chicago City Council committee on streets and alleys south last week, the ordinances of the Chicago City Railway company for the changing of the motive power from horse to electricity were taken up. New routes are proposed for some streets and for the connection of some of the existing lines. The most important features are the proposed changing to electric power on Clark street, from Washington to Twenty-second street, and the continuance of the Forty-seventh street trolley line from Cottage Grove avenue to the Illinois Central right of way.

A Baltimore dispatch says that P A. B. Widener, W. L. Elkins and Thomas Dolan of Philadelphia, had a conference in Baltimore on June 28th with the directors of the Baltimore Traction company and the officers of the Washington & Baltimore Boulevard company, and it was determined to push the work of construction of the stone ballasted trolley line to Washington. Additional contracts were awarded and it is expected to have the road between the two cities in operation in the fall. The extension of the traction syndicate connections in the direction of Gettysburg was also considered. The branch to Emory Grove and Reisertown is now in operation, and it is said that the construction of the Westminster branch will not be long delayed. The scheme is to connect the several Maryland lines which are controlled by the traction syndicate with the Gettysburg railroad. It was reported that Messrs. Elkins and Widener also had another conference with the officials of the City & Suburban company with the view of securing control of the latter's extensive system in Baltimore.

## TELEPHONE.

The Bell Telephone company of Montreal will erect a six-story building on the block of land bounded by St. John, Notre Dame and Hospital streets, to cost $250,000. The main operating room will be 32 feet wide and 128 feet long.

In speaking of the work of the Treasury Department for the fiscal year just ended, a Washington correspondent says: During the year perfect telephonic connection between Scotland lightship and the shore has been established. This is one of the greatest achievements in electrical application, and seems to demonstrate that telephonic communication with simple appliances can be had with the shore by a vessel many miles at sea without any direct metal connection.

## MISCELLANEOUS.

Press dispatches from Springfield, Ill., announce that final incorporation papers of the Inter-Ocean Electric Railway company of Chicago have been granted. The capital stock of the company is $200,000,000. The object of the corporation is to construct, operate, lease, bond and mortgage electric railways, both surface and elevated, telegraph and telephone lines, to manufacture coaches, sleeping cars, water and electric power machinery, and to issue bonds and mortgages upon all such property. Henry E. Beasley is the projector of the enterprise. A daily paper speaks of the concern as follows: "The Inter-Ocean Electric Railway company has been hovering about Chicago for a couple of years in various stages of progress. This is the first time it has reached the point of incorporation, and the projectors have concluded evidently to include nearly everything else in sight while they were about it. The chief object is to build an elevated electric railway between New York and San Francisco. It is proposed to construct the line first from New York to Buffalo, and thence extend it west as far as possible in intermittent stages. The project has been hampered somewhat in the past by the unqualified statement of engineers and electricians that such a road was a practical impossibility. When electricity should reach a development that made it feasible as a motive power in transcontinental transportation it would be applied to some of the many surface roads now in operation. It is not alleged by any of the incorporators that capitalists have been found who were willing to back a contrary opinion."

## TRADE NEWS.

Henry Sachs, manager of the Beacon Vacuum Pump & Electrical company of Boston, has resigned his position with that corporation. Mr. Sachs' present address is 21 Harcourt street, Boston, Mass.

The W. J. Davis Electrical company of Pittsfield, Mass., is very busy in completing orders given in the spring for its alternating current fan. A special discount will be given after July 1st upon fans running on 50 volts.

The glorious Fourth was celebrated by the American Electrical Works of Providence by sending out an imitation rocket inclosing a tiny American flag. This ingenious souvenir also contained the information that "There is but one American flag and but one American Electrical Works."

J. W. Packard of the New York & Ohio company of Warren, O., has issued a notice calling attention to the fact that lamps are being offered for sale as "Packard" lamps that are not manufactured by the company and warning purchasers to buy none excepting from authorized agents. The Electric Appliance company is the general western agent.

The Hart & Hegeman Manufacturing company of Hartford, Conn., has been unusually busy during June in taking care of increasing business. The Hart snap switch manufactured by this concern has become one of the staple articles in the electrical trade, and the large call for it would indicate that contractors are desirous of having as good an article as there is in the market.

Charles D. Mosher of No. 1 Broadway, New York, has issued a pamphlet giving information regarding the practical use of the steam separator. It is something that is of benefit to all engineers and those having in charge such apparatus. It will be sent upon application to Mr. Mosher, who is known in connection with the installing of steam plants in use upon the fastest steam yachts in the country and boats of larger build, and who is considered authority upon such matters.

The tenth edition of the revised catalogue of W. R. Ostrander & Co. of 204 Fulton street, New York, manufacturers of patented speaking tube hardware, electric bell goods, electric light material, telegraph and telephone goods, general electrical supplies, bell hangers' hardware and pneumatic call bells, shows that this reliable firm has added a large number of specialties to its stock since the ninth catalogue was issued. The new edition contains nearly 200 pages, is profusely illustrated, and contains much valuable information.

Last February the firm of Field & Hinchman of Detroit decided to give up the contracting business and devote itself entirely to consulting electrical and mechanical engineering. The business has increased so fast that it has been found necessary to move to larger offices, and the firm is now at 25–26 Hodges building. It is at present engaged to superintend the following named electric installations: New warehouses for Traugott Schmidt & Sons, Masonic Temple, Central High School, new Valpey building, W. H. Frear's Bazaar, Troy, N. Y.; German Lutheran Church, Ann Arbor, Mich., and a number of smaller installations. In addition to the above Field & Hinchman have recently completed the superintendence of electric light plants in several other buildings.

Stanley Green, of the Fuel Economizer company of Matteawan, N. Y., is now erecting an economizer of 150 horse power in the basement of the James A. Miller building, South Clinton street, Chicago. This economizer will take the water from an exhaust heater, receiving the water at a temperature of 200° and raising it to the neighborhood of 300°, through the use of the waste gases from the boiler. "Keep your eye on this," writes Mr. Green, "and remember that we begin where heaters leave off.

This economizer goes in on its merits; your humble servant had a "pull;" the economizer sold itself to an engineer with brains. Send 'em along to 1540 Marquette building; I'll do the rest. The moral is: Take care of the pennies (i. e., small waste products) and the dollars (coal bills) will take care of themselves."

## BUSINESS.

Thomas Carlin's Sons of 186-190 Lacock street, Allegheny, Pa., show their types of contractors' tools and machinery, engines, boilers, etc., in a comprehensive catalogue.

The Electrical Engineering company of 249 Second avenue, S., Minneapolis, Minn., has secured the northwestern agency of the Siemens & Halske Electric company. An encouraging increase of business is noted.

In a pamphlet bearing the title "Truths" the Hogan Boiler company of Middletown, N. Y., makes prominent the assertion that "Hogan water-tube boilers are of the same economic efficiency at all times, because scale does not accumulate on the heating surfaces of these boilers."

The Electric Appliance company is making special inducements on flexible switch cords for electric railway and other uses. The company claims to have a superior article at a low price in the Paranite flexible cable, and to carry one of the largest stocks in the West, enabling it to make prompt deliveries of large orders and special sizes.

From the bustling store of the Central Electric company, 173 and 175 Adams street, Chicago, comes the cheering news that never before has the company enjoyed such a large trade in the Lundell fan motor. The merits of this excellent fan motor have become widely known, and the fact that the demand is steadily growing, year by year, proves that quality will tell in the long run.

The Wallace Electric company of 305 Dearborn street, Chicago, announces that E. L. Barr has succeeded Mr. Berg as secretary of the company. Mr. Barr is well known to the trade through his former connection with the Canadian General Electric company, and more recently as traveling salesman for the Wallace company. The company is closing out its merchandise business and in future will devote itself exclusively to the interests of the manufacturing companies which it represents in the West. Its line embraces all important electrical material and specialties.

The Adams feed-water heater and purifier is an improved type of the class of open heaters, by which the water is heated to nearly or quite the temperature of the exhaust steam, scale-forming impurities are removed, and about 15 per cent. of the exhaust steam is condensed and mingles with the water in the heater. This heater is manufactured by the Adams Boiler company of 807 The Cuyahoga, Cleveland, O., and so confident is the company that it has the very best that can be produced that it will furnish the heater to responsible persons, placing it with them subject to trial and test for efficiency, its acceptance being conditional upon its proper performance. Orders are filled on this basis.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued June 25, 1895.*

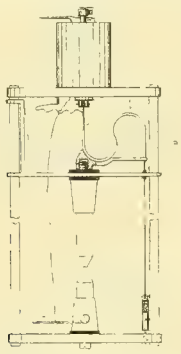
541,460. Electric Arc Lamp. Albert W. Smith, Washington, D. C. Application filed April 25, 1895.

A flexible feed ribbon engages with a retarding device on the movable carbon support, and means are provided for imparting an up and down movement to the ribbon, and also for varying the tension on the ribbon.

541,465. Electrolytical Process and Apparatus. Claude T. J. Vautin, London, Eng. Application filed June 26, 1894.

The process for the production of alloys of lead, tin and alkaline metal described consists in supplying lead and tin intermittently to an electrolytical furnace, supplying a fused alkaline salt thereto, superposed thereon, and discharging intermittently alloys of lead and tin with volatile metals when formed electrolytically, treating the alloys by distillation while still molten, condensing the pure distilled volatile metals, and returning the non-volatile metal to the reducing furnace.

541,467. Method of Preventing Electrolysis of Pipes Under Ground. Harold P. Brown, New York, N. Y. Application filed December 10, 1894.



NO. 541,460.

The trolley wire is connected with the positive pole of a dynamo plant; the rails are connected with the negative pole, and underground metal pipes are connected with the negative pole of a dynamo of higher potential than that to which the rails are connected.

541,471. Electro-magnet. Fred B. Corey, Boston, Mass. Application filed April 15, 1895.

In an electro-magnet having segmental pole surfaces there is the combination with a revoluble armature of pieces of magnetizable metal loosely fitted into recesses in the armature, in such manner as to be drawn into contact with the pole surfaces when current is admitted to the energizing coils, and retard the movement of the armature.

541,473. Fuse Block. Harry P. Davis and Charles F. Scott, Pittsburg, Pa. Application filed October 23, 1893.

This is a fuse block, comprising a base and cover, terminals extending through both parts, a fuse having its ends in engagement with the terminals, means co-operating with terminals for clamping the base, terminals and fuse together, and means engaging the ends of the terminals for clamping the cover to the base.

541,491. Repairing Incandescent Lamps. Joseph Mohrle, Munich, Germany. Application filed January 25, 1895.

This process of restoring incandescent lamps consists in forming an opening in the glass globe, then removing the old filament, then cleaning the electrodes and applying to them a cement comprising a mixture of carbon and a solution of a metal salt, then inserting a new filament into the cement on the electrodes, then drying the cement, then applying more cement, and finally fusing the cement by a current of electricity.

541,497. Electric Elevator Apparatus. Francis B. Perkins, Boston, Mass. Application filed December 15, 1892.

The combination with the motor, rheostat and switch controlling the circuits of the motor, of a brake magnet included in the circuit, the arrangement being such that, as the circuit is closed to start the motor, a greater portion of the current shall flow through the brake magnet to operate the same.

541,500. Electrical Controller for Motors. Oscar H. Pieper and Alphonse F. Pieper, San Jose, Cal. Application filed April 30, 1894.

In an electric controlling device, the combination of a portable case, a rheostat and flexible conducting wires connecting the same to an electric motor, a removable top plate for the case, an independent basal weight within the case, which is secured therein, and is used for anchoring the device and enabling it to remain stationary when being operated, the laterally movable operating pedal, and the return springs for returning the pedal to its central position.

541,541. Carbon Electrode for Electric Arc Lamps. Salomon Heimann, New York, N. Y. Application filed October 5, 1894.

A carbon electrode for electric arc lamps is used, in which are incorporated infusorial earth, chloride of zinc, chloride of ammonia and yellow prussiate of potash.

541,542. Automatic Working Rheostat for Starting Electric Motors. Frank E. Herdman, Winnetka, Ill. Application filed November 24, 1894.

This arrangement comprises an electric motor, resistances in the armature circuit an arm for controlling the resistances, a driving device adapted to be driven by the motor, a device adapted to be rotated by the driving device, connection between the last mentioned device and the resistance arm, the connection being such that when the device rotates the arm is moved over the resistances, and means to throw the rotatable device in and out of connection with the driving device, and mechanism to limit the extent of rotation of the device.

541,543. Automatic Working Rheostat for Starting Electric Motors. Frank E. Herdman, Winnetka, Ill. Application filed November 24, 1894.

The features claimed for this invention are: Resistances in the armature circuit, an arm for controlling the resistances, a driving device adapted to be driven by the motor, a device adapted to be rotated by the driving device, an operating sheave, a ring contiguous to the sheave, an electric clutch adapted when energized to connect the sheave and disk together, and when demagnetized to release the disk from the sheave, a notch in the disk, a hub having arms, one of which carries a roller, the other a weight, means to hold the roller against the face of the disk, a rotatable device, a sleeve connecting the rotatable device and hub, and connection between the resistance arm and hub, whereby the arm is moved over the resistance, when the hub is rotated, a circuit to the disk clutch, and means to close the circuit in the movement of the sheave in either direction, independent of the motor switch.

541,544. Electric Motor. Frank E. Herdman, Winnetka, Ill. Application filed November 27, 1894.

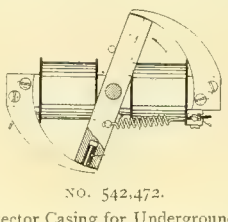
In combination with a translating device there are a reversing switch, a source of current supply, electrical connection between the source of current supply and electric switch and between the switch and translating device, resistances in the last mentioned circuit, an arm for controlling the amount of resistance in the circuit, an insulation upon which the arm is adapted to rest at one end of its travel, mechanism to operate the switch, a device connected with the mechanical but disconnected with the resistance arm, the arrangement being such that in the movement of the switch in either direction from the center the device will move the resistance arm.

541,545. Electric Brake Controller. Frank E. Herdman, Winnetka, Ill. Application filed December 18, 1894.

Claim one follows: The combination with an electric motor, of a brake for said motor, a solenoid to control said brake, a switch in the circuit to said solenoid, and a solenoid in the armature circuit, the core of which is adapted when energized to move said switch and break the circuit to the brake solenoid.

541,549. Automatic Electric Gas Lighter. William N. Jaskey and Edward S. Else, Logan, Utah. Application filed August 20, 1894.

A burner, a fan support extending above the burner, a fan pivoted to the support, and electrical contacts also mounted on the fan support, arranged to be actuated by the movement of the fan.



NO. 542,472.

541,552. Protector Casing for Underground Electric Conductors. John A. Kingdon, London, Eng. Application filed August 9, 1894.

The casing comprises a plurality of metallic sectional U-shaped troughs or sections resting upon the top of the conductor and projecting downwardly beneath the same to incase the conductor and protect it from mechanical injury, and a longitudinal continuous strip of wood inserted between the lower ends of the channel and forced upwardly into the same to bear against and support the conductor, the channel sections being secured together at their adjoining ends.

541,603. Electric Arc Light. Edgar A. Edwards, Cincinnati, O. Application filed September 19, 1894.

The first claim is for a housing, having a central recess for the reception of a block of refractory material, and tubular lateral extensions for the reception of the carbons, the extensions being provided with longitudinal slots.

541,604. Alternating Current Motor. Rudolf Eickemeyer, Yonkers, N. Y. Application filed September 23, 1891.

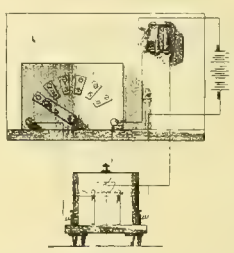
An armature, suitable field metal, and a continuous magnetizing coil, having diametrically opposite connections for receiving an alternating electric current, portions of the coil opposite each other, but unsymmetrically located with reference to the current-feeding connection, being shunted upon themselves, the coil when excited by an alternating electric current affording phases of magnetism at the non-shunted portions, which differ from the magnetic phases afforded by the induced currents set up in the shunted portions, and cause a rotation of the line of magnetization.

541,608. Electric Switch. William P. Hancock, Everett, Mass. Application filed February 7, 1895.

In an electric switch the carrier is provided with the curved slot and the blade with the longitudinal slot, the carrier and blade being both pivotally secured to an electrical connection with the feed wire, and the traveling pin moving in the slots and extending from one to the other.

541,615. Transmission of Power by Alternating Currents. Fred S. Hunting, Fort Wayne, Ind. Application filed January 19, 1895.

Included in this arrangement is a transformer, consisting of a core formed with two slots, primary and secondary coils wound therein at opposite ends to generate between them a



NO. 541,724.

consequent magnetic field and tertiary coils wound in the slots to inclose the lines of the consequent field, and having terminals for connecting a consumption circuit.

541,641. Electric Motor. William J. Still, Toronto, Can. Application filed August 9, 1894.

A hollow cylindrical armature comprises a series of substantially rectangular wire loops arranged in sets, the side of each loop of each set fitting under the corresponding side of the next adjacent loop of the set, so as to form a complete cylinder of double layer arc-shaped sides, the ends of the loops being arranged to overtop each other, and the ends of the wires of each loop being connected to a corresponding section of the commutator.

541,719. Burglar Alarm. Charles M. Clark, New York, N. Y. Application filed April 12, 1895.

An electric circuit, one or more magnetic coils, a galvanometer in the circuit and actuated by a person moving, and causing the movement of a metal into or out of the magnetic field of the coil, and an alarm controlled by the galvanometer.

541,723. Electric Gas Lighter. John L. Creveling, New York, N. Y. Application filed January 21, 1895.

One claim is given: The combination of a fluid cock or valve, an independently movable electric circuit controller, a handle for simultaneously operating them, and means for returning one of them to its original position when the handle is released.

541,724. Thermo-controlled Electrical Heater. Levitt E. Custer, Dayton, O. Application filed December 22, 1894.

The combination includes the electrically heated muffle and the main electric circuit, a spring actuated circuit-breaking plate arranged in the main circuit, an electro-magnet for releasing the plate, allowing it to break the main circuit, a thermo-contact maker in the muffle, and a shunt circuit including such contact maker and the electro-magnet.

541,796. Trolley Finder. James P. Taylor, Fort Worth, Tex. Application filed March 12, 1895.

A trolley guide is pivoted on the ends of a trolley wheel shaft, the guide consisting of a piece of sheet metal, having bearings for a spindle, a spool mounted on the spindle, and a clevis mounted in apertures in the guide.

541,798. Device for Removing Resistances in Starting Electric Elevators. George H. Whittingham, Baltimore, Md. Application filed May 24, 1894.

The features of this invention are: A revoluble shaft of the operating mechanism of an electric elevator, a switch plate and its resistances, an electro-magnet, a switch arm, and means whereby when the magnet is energized the revoluble shaft of the elevator mechanism will afford the power or motion to move the switch arm from the position of greatest resistance to the position of least resistance.

# Western Electrician.

EVERY SATURDAY.

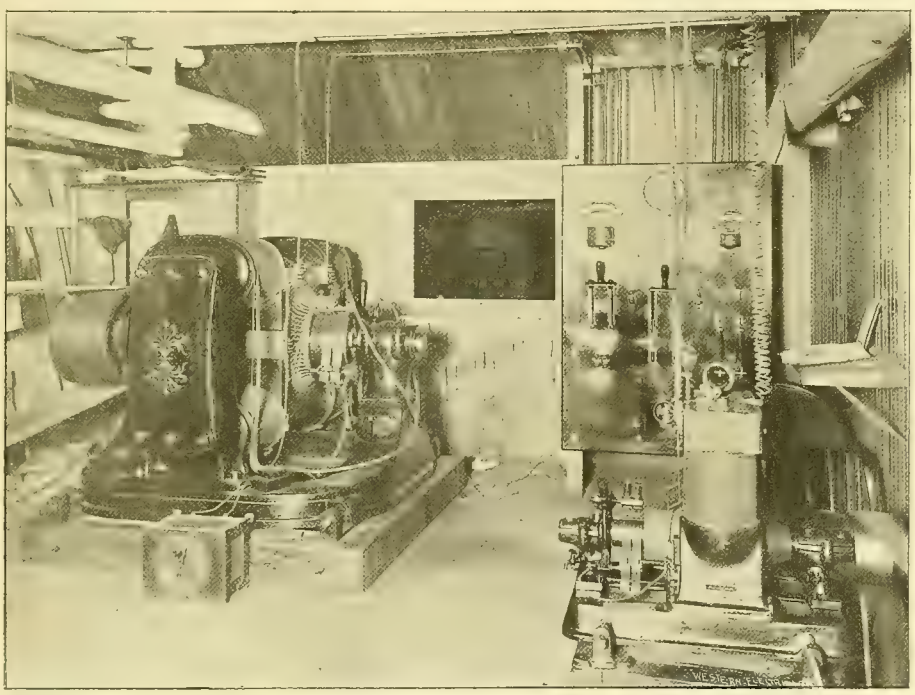
Vol. XVII. CHICAGO, JULY 13, 1895. No. 2


## Electric Lighting in a Freight House.

Isolated plants for electric lighting are common enough, and the one illustrated herewith presents no especially noteworthy features, but possesses interest from the fact that it is installed in a freight house and general office building for a railroad company. These warehouse structures are peculiarly well adapted for electric lighting, yet few are equipped with separate plants. In the building under consideration—the general office building and freight house of the Monon line (Louisville, New Albany & Chicago Railroad company) at 198 Custom House place, Chicago—the incandescent light is relied upon exclusively. There are no gas pipes in the building, and the current is generated on the premises.

The plant is placed in the basement and, as shown by the picture, consists of two engines and two dynamos. One pair is designed to carry the working load, and the other, much smaller, is used as an auxiliary and reserve. Steam from the elevator and heating plant of the building is carried to a Watertown simple engine, having cylinder dimensions of 13 by 14 inches and rated at 100 horse power. This engine, operating at 275 revolutions per minute, is directly belted to the pulley of the large dynamo shown on the left in the picture. This is a Fuller four-pole machine wound for 125 volts and of capacity sufficient to supply current for 1,000 16 candle power lamps. The field magnets are disposed horizontally about the armature. The upper poles are apparently continuous, but are magnetically separated by strips of bronze. A similar arrangement at the lower pole pieces makes a four-pole dynamo out of what seems to be a two-pole machine. The armature is of the Pacinotti type and is driven at 720 revolutions. The portable resistance box shown in the picture is wired in the field circuit to cut down the potential to 110 volts, as the lamps are all of that voltage.

A vertical Dake 10 horse power engine on the right drives a 60 light Edison bipolar dynamo used for light load and as a reserve. The switchboard is of polished black slate, with Weston instruments, and is provided with a change-over switch, each machine being independently connected. From this board current is distributed to 321 lamps of 16 and 32 candle power and to one one-eighth horse power motor which drives a ventilating fan.



ELECTRIC LIGHTING IN A FREIGHT HOUSE.

## Metallic Sodium Produced by an Electrolytic Leak.

The Boston correspondent of the WESTERN ELECTRICIAN writes as follows of an interesting discovery in the Hub:

The accidental sounding of an automatic fire alarm in a Washington street business house recently has brought to the attention af the Boston Board of Fire Underwriters a possible new source of danger from electric wires. According to the reports, for some time past a slight smoke has been seen issuing from the casement about the electric light wires in the basement of the Pray building at the point where the wires enter from the street. When the insurance inspector arrived and the casement was removed, it was found that a peculiar substance had accumulated about the wires, which, when moistened and struck with any hard substance, would give off flashes of fire. All around this point the woodwork was covered with a thick liquid which had dried in places to a white substance resembling discolored salt, and which was slippery to the touch and strongly corrosive. The wood itself was soft and badly discolored. As this case was thought to be of considerable importance, the matter was placed in the hands of Forbes & Glidden, electrical and chemical engineers, who immediately began an investigation. The deposit discovered about the wires proved, upon analysis, to be mainly metallic sodium. This substance is exceedingly combustible, and unites so readily with water that its presence in a damp cellar would be impossible under ordinary conditions. When it unites with water hydrogen gas is given off, and at the same time a considerable amount of heat is generated. Under certain conditions this heat would be sufficient to ignite the hydrogen gas. Hydrogen gas and air would form an explosive, and hence the greatest danger lies in the liability of an explosion if the gas should become ignited.

The explanation of the appearance in a damp cellar of a substance so combustible and unstable in the presence of moisture as metallic sodium is given as follows: The metallic sodium was undoubtedly the product of an electrolytic decomposition of impure sodium hydrate. This sodium hydrate came from the cement mortar used in laying the brick wall of the basement upon which the wires were supported. Some of the hydrate may have possibly worked its way through the wall from the cement used in the foundation of the paved street immediately adjacent. The electric current which caused the electrolytic action was due to a leak inside the casing from one of the mains. The leak was produced by the action of the sodium hydrate on the insulation covering the wires. This covering was what is known as weather-proof insulation, which consists of a cotton braiding covered with tar. Such a material is readily attacked by sodium hydrate, and its insulating properties destroyed. Moreover, the sodium hydrate itself furnishes a good path for the current when it has once penetrated through the insulation. This case is especially interesting in connection with several of the explosions which have occurred in underground conduits, usually attributed to a leak in the gas mains. In the London papers recently it has been suggested that metallic sodium may possibly have something to do with these explosions. This, however, appears to be the first instance in which the appearance of metallic sodium has been proved and a complete explanation of an actual case given.

## Telephone News from the Northwest.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

The telephone line between Great Falls and Lewiston, Mont., is completed and in operation as far as Stanford, about 65 miles. The total length of the line will be 120 miles. J. T. Armington and S. S. Hobson are building it and will form a stock company.

The Indianapolis Telephone company is canvassing Des Moines, Ia., for subscribers, and if 1,000 are secured it will put in an exchange. The company is making good progress toward securing the required number and will probably succeed. The old company threatens to reduce its rates to the basis proposed by the new concern, $24 and $36 for home and business places.

The Rocky Mountain Bell Telephone company has its line nearly completed between Great Falls and Helena, Mont.

The Wisconsin Telephone company has reduced its rate at Eau Claire, Wis., from $40 to $36 for business firms and from $30 to $24 for residences. At the same time all calls between Eau Claire and Chippewa Falls above a stipulated number will be charged at 10 cents a call. Superintendent Whistler says the cause for this provision is that many young people utilize the interurban wire to do their "sparking," and while he does not announce that the company wishes to discourage such practices, it evidently does intend to have them paid for.

The Standard Telephone & Electric company of Madison, Wis., has increased its capital stock from $500,000 to $750,000. The company is now turning out 30 to 40 telephones daily and expects to increase this number to over 100 during this month, as it is hindered now by inability to secure materials.

The Northwestern Telephone Exchange contemplates putting in a sub-central station in Minneapolis to relieve the underground system and to improve the service.

A peculiar accident furnishes the basis of a damage suit by Mrs. Sarah Lewis of Sioux City, Ia. The Home Telephone company had dug a number of holes for poles, and Mrs. Lewis, while walking in tall grass, stumbled and plunged into one, head downward. It was seven feet deep and so narrow she could not move her arms, so she was imprisoned for half an hour before she was found and pulled out. She wants $5,000 for the experience.

There is a scheme on foot to form a local telephone company at Anoka, Minn.

The Wisconsin Telephone company has secured a franchise at Menasha, Wis.

The council of Duluth, Minn., is wrestling with a subway franchise for the Duluth Telephone company and has so changed it in committee that it is an entirely new ordinance. Any other telephone or telegraph company can use the subways by paying a proportionate sum of the cost. The police and fire departments are to be furnished 100 lines without charge and the city is to pay but one-half the subscribers' rate for the use of telephones. The city is to be paid 20 cents per lineal yard per annum for the first three miles and 15 cents for each yard beyond three miles.

The Inland Telephone & Telegraph company has opened an exchange at Lewiston, Idaho., with 20 subscribers. It has also opened long line service into the Camas prairie country in North Idaho, with stations at Mt. Idaho, Grangeville, Denver, Cottonwood and Waha Lake.

## Paris Exposition of 1900.

From the preliminary report of the director-general some conception may be formed of the extent of the Paris Exposition which will mark the birth of the new century.

The accompanying map, which is taken from *La Nature*, will assist in the more perfect comprehension of the design and extent of the undertaking. Unfortunately this map, unlike the majority of such illustrations, is not true to the geography of the city, the lower left-hand being not southwest, but north. The relative positions of the various points can only be shown by reversing the page, and viewing the map cornerwise.

The grounds chosen for the exposition touch the heart of the city. The Entree d'Honneur, the grand gateway, is on the proudest avenue of the city, in front of the residence of the president of the republic. A grand perspective opens from that point having a width of 60 meters, reaching to the Hotel des Invalides, which covers the tomb of the first Napoleon.

The first great exposition of France was held in the Palace of Industry, which has long stood in a position to obstruct this fine view, and while it is regretted on account of the many remembrances connected with it, the architectural reasons outweigh sentiment, and down it must come.

The line of perspective, which ends at the Hotel des Invalides, will cross the river Seine over a steel bridge with but a single span.

The tower, from its summit of 300 meters, will still afford the curious visitor an opportunity to view the beautiful panorama at his feet. Some changes will probably add to its beauty, but as a whole it will remain as now.

The site of the removed Palace of Industry, facing the Seine, has upon its right the broad and beautiful avenue of the Champs-Elysées, which leads to the Bois de Boulogne, at the left the Champs-Elysées, and, farther on, the Place de la Concorde with its obelisk, the Garden of the Tuileries, and the palace of the same name, where royalty once held sway. In the rear of the Palace of Industry stands the Palace d'Elysée, the residence of the president of the republic.

No other spot in the entire city is capable of so much beautiful landscape distance, such magnificent perspective.

Entering along this grand promenade, upon the right will be seen the pavilions of the Administration, of Education and Instruction. The Palace of Fine Arts will be erected in front of the Invalides, and facing this, to the left, the Palace of Retrospective French Art will be built. These two will be so constructed as to permit of their remaining permanently after the exposition.

Around the site of the palace, which, as already remarked, is to be removed, will be found a veritable domain of art, for its union bridge, the space of the Esplanade of the Invalides, and all the vicinity will be consecrated to decorative art of every description.

On the right bank of the Seine, from the bridge of the Invalides to that of l'Alma, the space will be occupied by the Palace of the City of Paris, that of Horticulture, Social Economy and the congresses.

On the left bank, from the Invalides to the Champ-de-Mars, foreign nations, the army, marine, forestry, the chase and the fisheries.

In the palace of the Trocadero, Algiers, Tunis and the other colonies.

In the Champ-de-Mars, the larger industries and agriculture.

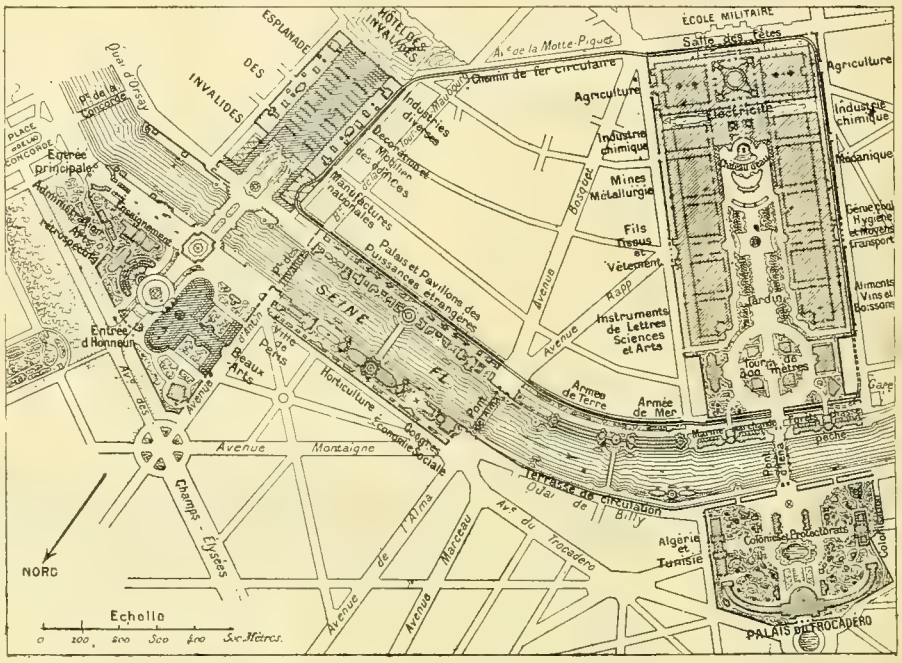
Electricity, with all the eclat that pertains to it, will occupy an enormous and radiant palace of glass, which stood in front of the grand gallery of machinery in 1889, transformed into a huge festival hall for the display of everything pertaining to electric light, heat, power, etc., on the most enormous and liberal scale.

Two wide footways will be provided near the bridges connecting the banks of the Seine, one of which will cross between that of l'Alma and the Invalides, the second between l'Alma and d'Iena.

An electric circular road will connect the Esplanade, the Quay d'Orsay and the Champ-de-Mars. There will be two roads to the Trocadero, one of which will be a steam cog-wheel affair.

The *terrasse de circulation* will permit of the freer movement of pedestrians between the palace of the Trocadero, along the right bank of the Seine, to the various exhibits on that side of the river, while a similar promenade on the left bank will afford equal facilities for the inspection of the foreign buildings, so that a complete circuit may be made on foot with ease for good walkers, while there will undoubtedly be plenty of chairs and baggy-legged Turks to assist the unfortunate, whether the cause of their indisposition be incurable or simply a chronic tired feeling; and where haste is a matter of moment the electric road will accommodate all.

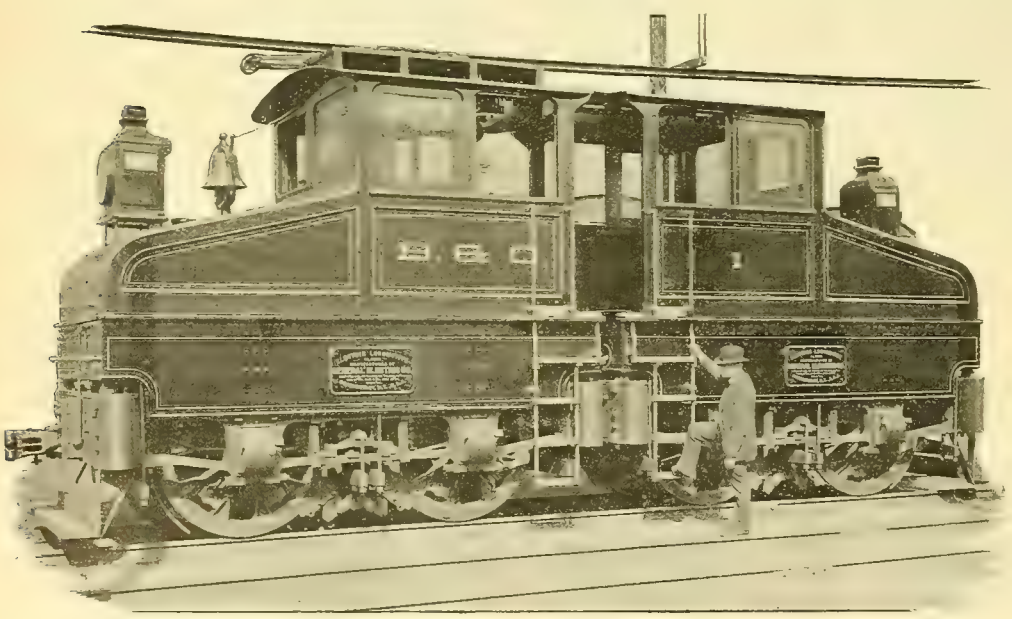
This is the programme in skeleton form thus far evolved. The territory covered is abundant, the picture attractive, and the situation more than beautiful. There is still much time for elaboration, and it remains to be shown whether it can be made as successful in every way as was that of 1893.




PARIS EXPOSITION OF 1900.—MAP OF GROUNDS SHOWING LOCATION OF BUILDINGS.

## Electric Locomotives on the Baltimore & Ohio Railroad.

Much has been written about the suppression of the steam locomotive by the electric locomotive in railway service, but few would have had the temerity to assert that within seven years after the first successful demonstration of the adaptability of the electric motor to city transit an electric locomotive vying in size and power and speed with the heaviest steam locomotives would actually be placed in service upon the tracks of one of the most important trunk lines in the United States. During these years, however, development has progressed, the capacity of electric power stations has steadily increased; generating plants have been improved and larger units employed; elevated railroads have been equipped for electrical propulsion, and are now operating, and the time has come for another and greater step forward—the operation of regular passenger and freight trains through the new Belt Line tunnel in Baltimore, on the main line of the Baltimore & Ohio railroad. The length of the tunnel is 7,339 feet, and the maximum dimensions, after lining, are 27 feet wide by 22 feet high. Its cost, ready for the track, is set down at $225 a lineal foot.



ELECTRIC LOCOMOTIVES ON THE BALTIMORE & OHIO RAILROAD.—SIDE VIEW OF NINETY-SIX TON LOCOMOTIVE.

The power house stands upon the west side of Howard street, east of the tracks leading to the southern portal, and between Henrietta and Montgomery streets, two blocks south of the Camden station of the Baltimore & Ohio railway. It is a one-story building rising 30 feet from floor to eaves, with walls of brick one foot five inches thick. The roof of slate is supported on iron trusses, and the building is practically fireproof. It is divided into two parts, the engine room, occupying the north portion, being separated from the boiler room by a brick wall. The entire length of the building is 322 feet one inch; the dimensions of the engine room are 223 feet 10 inches in length by 57 feet nine inche swide, and of the boiler house 98 feet three inches by 69 feet.

The boiler house is a spacious and lofty room, having 12 boilers (250 horse power) arranged in six batteries, three of which are placed on each side of the center passage. It is lighted from the roof. The boilers are of the Root water-tube type, from the shops of the Abendroth & Root Manufacturing company. Each boiler is 12 tubes wide and 11 tubes high with six 14½ inch drums and a 30 inch steam drum. Space is left for an additional boiler on the west side of the room.

A system of mechanical draft is employed, and the flues run over the rear of the boilers and taper from two feet nine inches square at the end to five feet square at the junction with the fan chamber, nine feet in diameter, in which two fans of the Sturtevant pressure pattern revolve at 240 revolutions per minute. This chamber is at the base of the iron stack, which is seven feet in diameter and 51 feet high from the floor. Each fan is belt driven by a 10 horse power ver-

ical engine, set upon the floor of the boiler room, and one of sufficient capacity to secure the necessary draft.

The boiler room is further equipped with a C. W. Hunt coal crusher and conveyor, which brings the coal to the boiler and carries away the ashes from the ash pits; with Deane duplex feedwater pumps, and a 3,000 horse power Webster feedwater heater.

The steam system is duplicate throughout, and was laid out in the engineering department of the General Electric company.

The mains from the boilers are placed high enough to allow the water to drop into the separators, whence a "Lux" drip system returns all water from this point back into the boilers by gravity, and prevents its passage into the engine room system. Each main is provided with a 49 inch separator. Each boiler has an angle check and stop valve, the object of which is to shut off automatically from the system any boiler in which a tube has given way, or any part of which has met with accident. A 24 inch separator is furnished to each power engine, and one of similar size for each pair of lighting engines. The steam piping is protected by Keasbey & Mattison magnesia covering.

The engine room is divided into two sections, one devoted to the power plant, the other occupied by the lighting generators. In the power section space has been provided for five direct-connected engines and generators, and four are now in place. The engines are horizontal, tandem compound Reynolds-Corliss machines, from the shops of E. P. Allis & Co., and have 24 and 40 by 42 inch cylinders.

The engines are built extra strong, on account of the severe work by which they will be taxed, and present the latest development of the Reynolds-Corliss type. Directly coupled to them are 500 kilowatt General Electric multipolar generators, adapted to run with the engine at 110 revolutions per minute. The armatures of these generators are overhung on the outer end of the shaft. The arrangement, in this respect, differs from the regular practice of railway generators. The armatures differ from standard practice in being wound for 700 volts potential and are of the iron clad-type, that is, the windings are embedded in slots cut into the outer periphery of the laminated armature body. The armatures are of the latest barrel wound type, and present a very massive appearance. The fields are of steel, according to the well known General Electric design, and run remarkably cool. The machine compounds from 600 volts no load to 700 volts full load. The performance of both the generator and engine under the severe fluctuations to which this character of work is subject shows that the apparatus must have been carefully designed, with reference to the peculiar conditions to which it was to be subjected.

From the railway generators the current is brought over cables, of 1,000,000 circular mils cross section, to a switchboard of white marble, erected on a platform raised at the south end of the engine room. This switchboard consists of four standard "K" generator panels, each equipped with all the necessary instruments for controlling and measuring the current from one generator. The machines are protected from accident arising from short-circuit by automatic circuit breakers, one of which is fixed to the upper part of each panel.

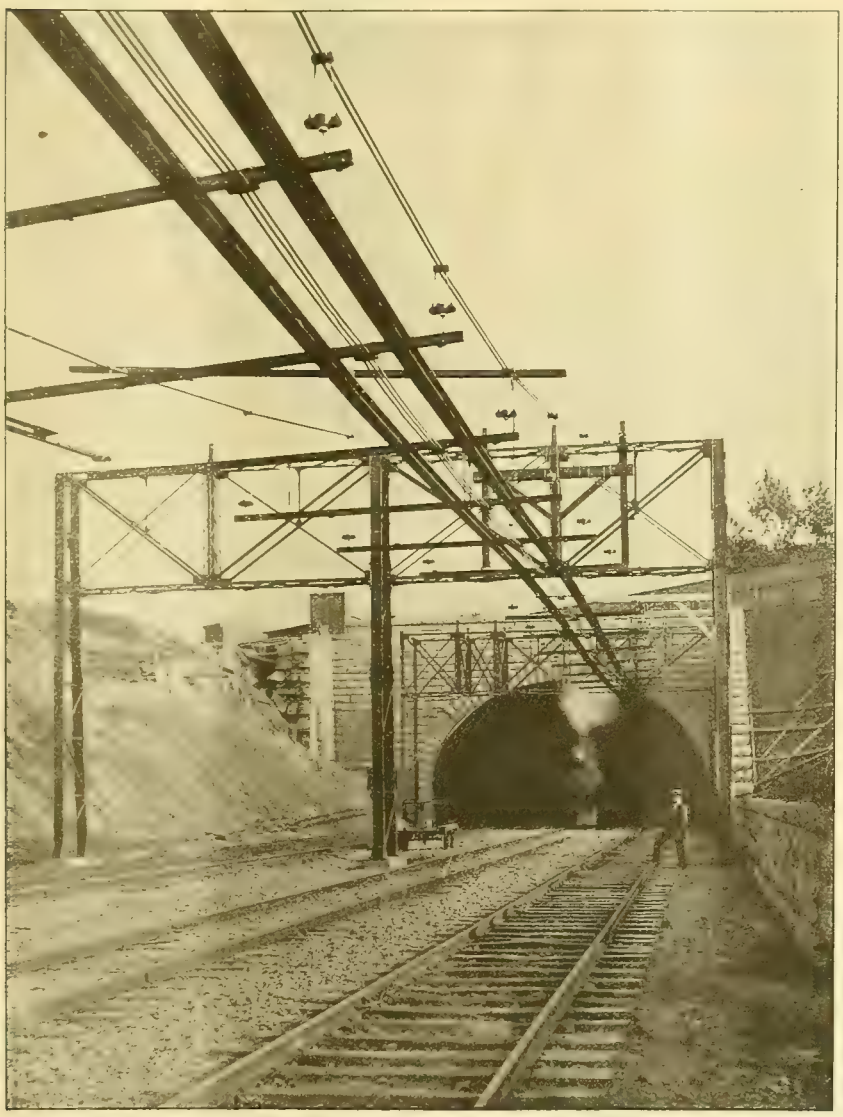
The northern section of the engine room contains the lighting plant, consisting of eight 50 light Thomson-Houston arc generators and two alternators for the incandescent lamp service in the tunnel. The arc light machines are belted to two cross-compound Armington & Sims 250 horse power engines, 16½ by 23 by 19 inches. Two other engines, of similar make and capacity, drive the two alternators, and space has been left for an additional engine and alternator. Each alternating generator has a capacity of 2,000 16 candle power lamps, and as the tunnel is lighted by 1,000 32 candle power lamps, one alternator will suffice for the present illumination of the tunnel.

Facing the lighting plant, on the east side of the room, is the lighting switchboard, also of polished white marble. It consists of one standard 20 circuit arc lamp plug board, to which only 16 circuits are at present connected; three alternating generator panels, one of which is left blank, and one feeder panel. The arc lamps used in the illumination of the power house are of the Thomson 1893 type. In addition, it is lighted by clusters of three incandesent lamps each, fixed to the walls. The approaches and stations are lighted by Thomson-Houston standard arc lamps.

From the positive bus on the railway switchboard, eight cables of standard copper, each of 500,000 circular mils cross-section, or a total cross-section of 4,000,000 circular mils, pass to the overhead structure immediately outside the power house, where connection is made to three feeder cables, of 1,000,000 circular mils cross-section each, and to the overhead conductor itself, which has an equivalent of 1,000,000 circular mils cross-section. The negative bus is similarly connected to the rails, which are double bonded with No. 0000 wire, and also to the return cables laid in a wooden box between the tracks. Perfect contact between bonds and web is obtained by using a hollow rivet on each end of each bond and expanding it, when inserted in the rail, by means of a conical steel pin.

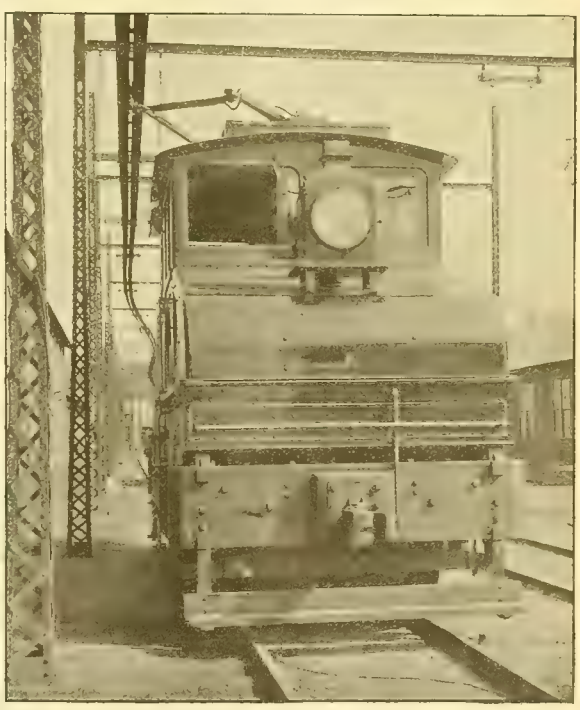
The distance over which the electrical locomotives will operate is about 15,000 feet, passing through two tunnels, 7,339 feet and 265 feet long, respectively, and over 7,396 feet of track in the open from Hamburg street to Huntington avenue.

The most interesting portion of the installation is, of course, the locomotives. Electric locomotives of such weight and power had never before been conceived, but it has always been a rule in American electric railway practice from the beginning, to push ahead where improvements were possible and make the results realize the expectations, and there has been no departure from the rule in this case. The



Entrance to the Tunnel.

Overhead Work on Viaduct.



End View of Electric Locomotive

ELECTRIC LOCOMOTIVES ON THE BALTIMORE & OHIO RAILROAD.

96 ton electric locomotive is a success. The dimensions are as follows:

| | |
|---|---|
| Number of trucks | 2 |
| Number of motors | 4—2 to each truck. |
| Weight on driving wheels | 192,000 pounds (96 tons). |
| Number of driving wheels | 8 |
| Drawbar pull | 42,000 pounds. |
| Starting drawbar pull | 60,000 pounds. |
| Gauge | 4 feet 8½ inches. |
| Diameter of drivers | 62 inches outside of tires. |
| Length over all | 35 feet. |
| Height to top of cab | 14 feet 3 inches. |
| Wheel base of each truck | 6 feet 10 inches. |
| Extreme width | 9 feet 6¼ inches. |
| Diameter of sleeve bearings | 13 inches. |

The driving gear consists of a cast-steel spider shrunk on and keyed to a cast-steel driving sleeve, having a tensile

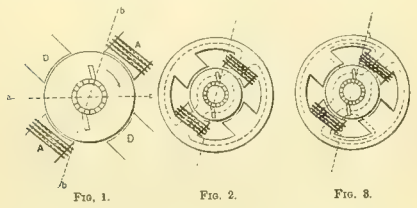


Fig. 1. Fig. 2. Fig. 3.

COMPOUNDING DYNAMOS FOR ARMATURE REACTION.

strength of not less than 80,000 pounds. Each arm of the spider is provided with a double rubber cushion, with a chilled cast-iron wearing cap, the cushion being forced into the arms of the spider and the cap. The eight driving wheels are of cast-steel pressed and keyed to the axles, and have tires, three inches thick at centers of tread, shrunk on to the wheel centers. The driving axles are of special open hearth steel. The journal bearings are outside of the driving wheels and allow of easy access to all parts of the truck frame and driving box. In the design of this are embodied the good features of the steam locomotive driving box and passenger car box. It is of cast-iron with a phosphor bronze bearing fitted on in a similar manner to that of a steam locomotive driving box. It slides in jaws protected by shoes in the same way. The box is closed at the bottom and has a well for oil and waste, as well as a dust guard lid, etc., similar to an improved passenger car box. Large grease cups are cast in the journal caps, giving a satisfactory lubrication to the motor bearings.

The two opposite side frames of each truck rest upon four wheels, each consisting of one piece of hammered wrought-iron, three and a half inches thick, to which the frame jaws are welded, and protected from wear by cast-iron shoes, and are connected together at the ends by heavy forged iron plates, with oak bumper beams between them.

The motors are supported on carriers bolted to the field magnets, and rest in adjustable hangers carried on half elliptical springs placed on top of the frame and bumpers. The frames thus carry the motors by carriers and springs, and this load is carried in turn by rubber blocks in a cast-iron casing.

The locomotive is fitted with sand boxes, and Westinghouse automatic driver and train brakes are provided for all wheels, bearing upon the flanges and outside tread only. A brass signal gong eight inches in diameter is placed in the cab to be rung from either end of the locomotive. The headlights, of which there are two, are placed on the top of the shields at each end, and are 23 inch lights of Baltimore & Ohio standard pattern.

The gearless motors are four in number, two to each truck, flexibly supported and transmitting their power to the wheels through the flexible connections described above. They are of pyramidal shape, are the largest railway motors in the world and, while ponderous in appearance, are by no means so bulky as might be expected from the heavy work they have to perform.

Each has six poles and six sets of carbon brushes, the brushes being connected to a yoke revolving through 360 degrees to facilitate accessibility to them. It is possible to remove four brushes without disabling the motor. The field spools are incased in sheet iron cases and fitted over the pole pieces bolted to the field frame. The armatures are built of sheet iron laminations and are series drum wound. They are known as ironclad, each insulated winding being embedded in an insulated slot cut into the outer surface of the armature body, and held therein by a wooden key. This armature, with the commutator, is mounted upon and keyed to the hollow sleeve which is carried on the journals on the truck frame. The inside diameter of the sleeve is about 2½ inches larger than the axle. The entire motor is practically fireproof.

Each motor is rated at 360 horse power and takes a normal current of 900 amperes.

The controlling devices and measuring instruments, etc., occupy the interior of the cab. The controller is erected in one half of the cab, and is of the series parallel type. The reversing lever projects through the upper plate of the controller cover. The resistances are placed around the frame beneath the floor of the cab.

The locomotive is equipped with a 1,200 to 3,500 automatic circuit breaker and one 2,000 ampere magnetic cut-out, a 5,000 ampere illuminated dial Weston ammeter and one illuminated dial Weston voltmeter. The compressed air for the whistle and brakes is supplied by an oscillating cylinder electric air pump, the air tanks being placed at each end of the complete locomotive. The interior of the cab is illuminated by clusters of incandescent lights.

Contact with the overhead conductor is effected by means of a sliding shuttle-like shoe of brass, which is fixed to a flexible support fastened to the top of the cab. This "trolley" support is diamond shaped and compressible, contracting and expanding as the height demands, and is arranged to lean on one side or the other as the locomotive runs on one side or the other of the overhead conductor. It is, however, rigid in so far as movement forward or backward over the locomotive is concerned. The current is brought to the locomotive by means of cables connected to the shoe and fastened to the "trolley" support.

The conductor is simply a reversed iron conduit or trough erected overhead on trusses in the open and in the tunnel attached to the crown of the arch. In the open the conductor is directly over the center of the track; in the tunnel over the center line of the space between the tracks. It extends from Henrietta street on the south to Huntington avenue on the north, a distance of 15,000 feet.

The conductor consists of two three-inch iron Z-bars, three-eighths inch thick, riveted to a cover plate one-quarter inch thick and 11½ inches wide, and is constructed in sections 30 feet long. It weighs about 30 pounds per foot. At intervals of 15 feet inside the tunnel there are suspended from the arch transverse frames, consisting of two three-inch channels, held together by plates four inches wide, and holding four castings, into which are fitted conical porcelain insulators. The height of the conductors above the level of the top of the rails is 17 feet six inches in the tunnel, and they are fixed a little on each side of the center line.

Outside the tunnel the height of the conductors above the rails is increased to 22 feet. The supporting structure in the open consists of longitudinal catenaries of two chains of iron rods, having a span of 150 feet suspended from transverse trusses supported by columns of latticed steel channels erected on either side of the double track. At the ends of the line an anchor pier receives the ends of the conductors. The trusses vary in length from 30 feet to 62 feet, the latter being required to span five tracks. All the iron work was made by the Maryland Steel company.

Upon the straight track the conductors are suspended from single catenaries, while upon the curves a double catenary is employed, and the conical insulator is inverted and supported in a casting bolted to the two vertical rods which drop from the catenaries. The vertical rods support a channel frame, to which are bolted the conductors and the feeder cleats, or clamps. Each joint of the conductor is bonded with a Chicago bond of two No. 0000 wires.

The feeder cables are of bare stranded copper of 61

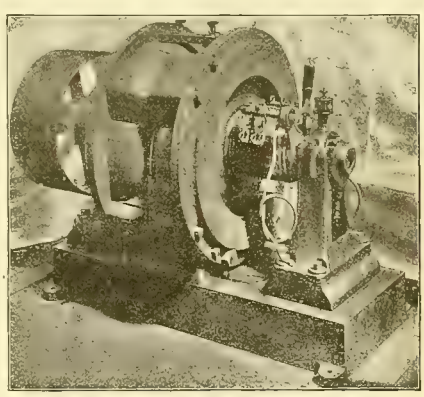


Fig 4

COMPOUNDING DYNAMOS FOR ARMATURE REACTION.

strands, of 1,000,000 circular mils cross section. These are supported in iron cleats fastened to channel frames riveted to the overhead conductors at points near to the heavier channels to which the conductors are suspended.

The lead covered primaries for the tunnel lighting plant are carried on posts set on the side of the cut, to the southern portal, where they drop to the tunnel and are carried upon n knobs fastened to wooden blocks bolted to the masonry. At the points of support the cables are armored with wire to prevent abrasion. The secondaries are carried in cleats, also fastened to wooden blocks similarly attached and placed on either side of the tunnel about eight feet from the ground and 15 feet apart. They are, however, staggered, and thus occur alternately at every 7½ feet throughout the tunnel. Each block carries a lamp at its lower end, and is there cut out so that the lamp socket may be protected from moisture and dripping water from the tunnel walls. The lamps used are 32 candle power, 52 volt Edison standard incandescent lamps.

On Monday last, during the test, a slight hitch occurred, acccording to the dispatches, when 24 loaded coal cars and a steam locomotive were attached to the electric locomotive. The motor was in charge of William Cooper. In addition there were aboard the motor Dr. Louis Duncan, S. H. Browne, L. H. Parker and Mr. Potter, who designed the controller of the motor. The start was a slow one, and it was evident that the test was about all the motor could stand When the middle of the tunnel was reached the shoe of the trolley was found to be red-hot and the connection from the shoe to the car broken. There was no time for repairs, for north-bound trains were expected, so the loco-

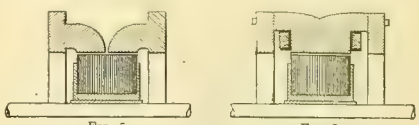


Fig. 5. Fig. 6

COMPOUNDING DYNAMOS FOR ARMATURE REACTION.

motive to which the cars were attached made an effort to pull the motor, train and all. But it could not budge them. The cars were then divided into two sections, and the motor and nine cars were first taken through and then the 15 cars were pulled through by the locomotive. The electrical engineers say that the trouble experienced can be remedied and that the test will be repeated in a few days.

## Compounding Dynamos for Armature Reaction.[1]

By Elihu Thomson.

Considerable attention has recently deen drawn to the subject of means for counterbalancing or preventing armature reaction in dynamo-generators or motors. The valuable paper of H. J. Ryan and Milton E. Thompson, read before the Institute at its meeting on March 20th, called forth considerable discussion as to the actual utility or need of added devices, which undoubtedly render a machine more complex, but which can certainly be made to obliterate armature reaction or overcome its effects. The opinion which seems to prevail amongst engineers is that by taking advantage of the best principles of design, the output of our machines is not limited by armature reaction but rather by heating, or the capacity to diffuse that heat which is sure to be produced during operation.

The writer's views are in accord with the general sentiment indicated by the discussion of the paper in question, excepting that he conceives that it may on occasion become desirable to possess a structure, either generator or motor, in which a load which would inevitably overheat the machine if continuous, may be borne without destructive results for short periods only. The development of engineering work may in fact demand, occasionally, machines which would be regarded as emergency machines, to be operated with the highest possible loads for short periods. It is sometimes desirable that a dynamo be adapted to driving at different speeds while maintaining the same potential at the terminals, as in the case of direct-driven dynamos coupled with engines of different makes and speeds. Such an adaptation would require a change in the armature turns, or in the field excitation, the former demanding a reconstruction amounting to the production of a special type, while the latter, change of field strength, might involve such a weakened field at the higher speeds as would be incompatible with proper commutation. In such cases means and methods for securing proper commutation and neutralizing reaction may become quite useful. The subject itself has been worked upon by the writer as far back as 1879. At first a peculiar disposition of the field coils and pole pieces was selected, unfavorable to armature reactions, and later, in a patent applied for by the writer in the year 1885, the series coil of a compound-wound machine was so disposed as to add, under load, a magneto-motive force to the field in the region of armature opposition, and as a consequence to diminish somewhat the magneto-motive force of the field where the reaction of the armature was positive, or assisting.

In the present paper, however, the writer desires to bring to the attention of the Institute a different type of dynamo, worked upon by him some three or more years ago, in which there is no series winding whatever, though the machine is in effect compounded, or over-compounded at will.

It is expressly to be understood at the outset that the present paper is not intended to advocate the disposition described as a desirable commercial structure, or even as one which will be likely to come into practical use on any scale. On the contrary, it is believed to be open to objections which would take it out of competition with ordinary types in which the compounding effect is secured by the series coil or load circuit wound as usual as a part of the field energizing conductor.

The machine is, however, interesting as bringing out forcibly the capability of the armature current to neutralize its own effects in a proper structure and maintain, or even increase, the potential at the brushes under heavy loads. In fact the current in the armature in the type of machine herein treated is made to react under load to magnetize a por-

1. Read at the twelfth general meeting of the American Institute of Electrical Engineers, Niagara Falls, N. Y., June 25 1895.

tion of the field structure which at no load is neutral or nearly so. The regulation must thus be made to give rise to a magnetic flux sufficient or more than sufficient to compensate for its effect in diminishing the flux of the other or exciting poles. The result is accomplished by dividing each field pole into a portion which is left unwound and a portion which is wound and excited in shunt or separately. At no load only, the wound polar portions act to generate the open circuit electromotive force. As the load is put on, the unwound or dead poles become active in consequence of a magnetic flux developed in them by the armature currents themselves, that is, in consequence of the magneto-motive force generated by the current in the winding of the armature itself. The disposition of the poles in a bipolar structure would be represented by Fig. 1, where *A A* are the excited poles, or wound field cores, under the fringe of which commutation is effected, while *D D* are the "dead" poles or sections of polar surface unenergized at no load. A dotted line *a a* may pass through the neutral or non-polar portion of the armature iron, threaded by all field lines on one side, while the lines *b b* may indicate the diameter of commutation on which the brushes rest. In such a structure, by choosing the position and spread of the "dead" poles in relation to that of the wound or excited polar portions, and adjusting the magneto-motive force of the initial field relatively to the turns on the armature and the speed of driving, the effect of compounding or over-compounding may easily be obtained. The "dead poles" may be made adjustable in position so as to vary the effective magneto-motive force of the armature upon them and various changes in relations of the parts are conceivable.

In Figs. 2 and 3 an attempt has been made to represent the magnetic flux under no load and under load respectively. In Fig. 2 the flux in the air-gap between the excited poles *A A* and the armature may be considered as of uniform density except at the edges, while in Fig. 3 it is, under the same poles, somewhat diminished toward the diameter of commutation. In Fig. 2 the dead poles are without flux across the air-gap, while in Fig. 3 the density increases from one edge to the other in the direction of rotation.

Fig. 4 is from a photograph of the dynamo constructed in accordance with the principle under discussion. It is multipolar, having four wound poles and four dead poles alternating in position around the armature. The latter is of standard iron projection type, being in fact identical in construc-

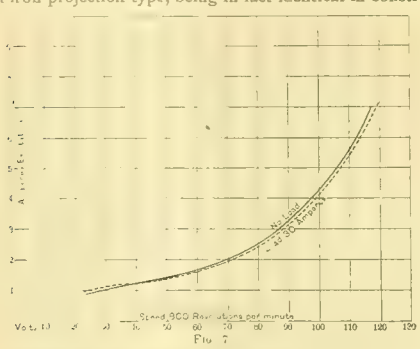



Fig. 7

COMPOUNDING DYNAMOS FOR ARMATURE REACTION.

tion and dimensions with the armatures used about three years ago in regular four pole dynamos of the marine type of the Thomson-Houston Electric company.

The principal data of the armature construction are as follows:

| | | |
|---|---|---|
| Diameter over all | 17 | inches. |
| Length (laminations) | 8 | " |
| Radial depth of laminations | 4 | " |
| No. of projections | 87 | |
| Width of slots | ·34 | inch. |
| Depth of slots | ·75 | " |

The armature is series drum-wound and has two conductors in each slot. The commutator has 87 segments. The new field system was constructed of two rings of cast open hearth steel having heavy lugs, four in number, projecting laterally from each ring on one side, and forming the dead poles when assembled in the machine. Separate castings for carrying the field coils and constituting the active poles were made, wound and bolted between the two ring castings of the field. The arrangement will be understood at a glance from an inspection of Figs. 5 and 6. Fig. 5 is a section of the field in a plane passing through the dead poles and the axis of the armature, and Fig. 6 is a similar section through the active or wound poles. The wound cores have a section of 3½ inches by eight inches and are of steel. The field was bored to 17¼ inches, thus giving a clearance of one-eighth inch around the armature. The excited or wound poles covered each about five inches, the dead poles each 5½ inches, leaving spaces between wound and dead poles of about 1½ inches. The face of each dead pole is 5½ by eight inches.

The coils on the active poles can be connected in shunt to the armature terminals with a variable rheostat in the branch, or separately excited as desired. It was found that for the purposes of test that the latter arrangement was most satisfactory, as the exciting current could then be adjusted to any given value and would remain undisturbed by variations in the potential difference between the brushes or terminals of the machine.

Fig. 7 shows the relation of volts at the terminals to varying exciting current at no load (full line) and at 30 amperes load (dotted line) with a speed of 800 revolutions per minute. It will be noted that the load has caused an increase of voltage particularly at the relatively higher excitations. The normal current of full load for the armature as constructed and used in the regular multipolar field was 140 amperes, and it was found that as the load was increased steadily during a run, the potential was not only maintained but increased with each increment of load, thus showing an over-compounding effect. This effect was less marked when the initial excitation was weak; as when less than three amperes traversed the field coils. The over-compounding under load was, of course, still more increased when the field coils were connected in shunt to the armature. Thus, at a little over 750 revolutions per minute, with an exciting current of four amperes, the open circuit volts were 84, rising to 104 when a load of 130 amperes was put on with an increase of the exciting current to 4.8 amperes.

It was noticed that on any considerable increase of load being made, the potential rose in some cases as much as five or six volts above the point at which it would remain, or which it would reach after a short interval. Similarly it was found that the sudden taking off of load caused a temporary fall below the stable voltage under the new or di-

Fig. 9

Fig. 10.

COMPOUNDING DYNAMOS FOR ARMATURE REACTION.

minished load conditions. This curious effect was traced to the difference of time between that needed to build up or cut down the flux in the dead poles, as compared with that required to cut down or build up the excited poles, which, being wound with wire, were naturally more sluggish under the conditions of use. Currents would be induced in the coils under each change of flux, which change itself would thereby be rendered more gradual. The dead poles being unwound could respond more rapidly. Any increase of load would of course tend to break down the wound poles and to increase the flux in the dead or unwound poles, and the taking off of load would have the opposite effect.

Fig. 8 shows a compounding curve obtained under a constant excitation of four amperes at a speed of 790 revolutions, the load being varied from 0 up to more than thrice the full load. It will be noticed that the potential at first increases and only breaks down under extremes of load. The final breaking down is doubtless due to saturation of the forward portions of the dead poles, together with the armature core projections. Part of the drop was undoubtedly due to resistance at the brushes, which were of carbon, and by no means fitted to conduct off such heavy currents. Taking this drop and the drop over the armature conductor itself, it is not surprising that at the high loads the potential should fall off.

A horizontal plotting of the potentials generated in the armature coils under no load, obtained by the two-brush method of Dr. S. P. Thompson, is given in Fig. 9, the relative positions of the wound and "dead poles" being marked in dotted lines, and the arrow indicating the direction of movement of the armature relatively thereto.

Fig. 10 gives the same plotting under a load of 100 amperes and accentuates the effect of the armature reaction in

Fig. 11.

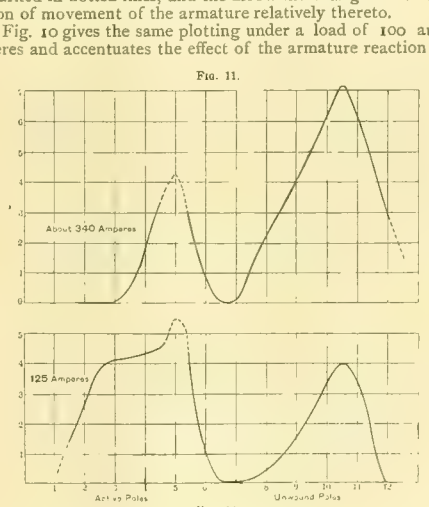



Fig. 12

COMPOUNDING DYNAMOS FOR ARMATURE REACTION.

magnetizing the dead poles. The curves are only approximate indications, owing to the fact that the number of points at which readings were taken was less than was desirable, and because in some cases it was difficult to maintain all conditions unchanged, particularly with the very heavy loads.

Figs. 11 and 12 show a similar plotting for abnormal or extreme loads. The former shows how completely the wound pole has been broken down by armature reaction, and how the unwound poles have now become the chief working field poles, or rather how the armature winding itself has furnished the field for its own cutting. A calculation of the flux density at the forward edge of the unwound pole shows that the magnetization has risen to saturation. The other parts of the pole are shown to be still susceptible of increase of flux, but their relation to the armature is far less favorable for its generation.

The machine described is probably chiefly interesting from a theoretical aspect. Still it shows clearly that so far as the effect of the series field on compound wound machines is concerned, the electrical engineer has other resources at his command giving similar results. It cannot be doubted also that the design of armature and field might be considerably improved with special regard for the particular feature of compounding. A feature of the machine which developed itself when carbon brushes were used was that even at heavy loads the brushes could be set back from their maximum position, or true diameter of commutation in this case, and that the movement was attended with little, if any, increase of spark, while the potential steadily went down. It was thus easily possible to adjust the potential by a backward movement of the brushes in the space between the unwound and wound poles, while the slight sparking under the carbon brushes was not increased thereby. The writer has never noticed this effect in so pronounced a degree in any other structures, but thinks it may not be peculiar to this machine.

A further interesting consideration is the effect of dispensing with the wound poles altogether, and either neglecting to employ any reversing or commutating field while maintaining the brushes near the forward edge of the field poles which now remain, namely, the unwound poles, or employing commutating arrangements similar to those used by Mr. Sayers, that is, returning the leads through slots in the armature under the strong induction of the forward edge of the pole as the armature leaves it. In such a case it would appear from theoretical considerations that the machine should, if it possessed any permanent magnetism, excite itself as a series dynamo entirely without any winding on the field and solely by the action of the armature winding itself. This fact was, I believe, first pointed out by Drs. J. and E. Hopkinson.

In conclusion it may be stated that tests of the machine used to generate single-phase and three-phase alternating currents in its armature winding were made by dispensing with the commutator and substituting rings and connections common in such cases. The results indicated a substantially similar effect of compounding, but to a less degree, owing, no doubt, to the fact that the phase of the electromotive-force generated by the wound pole flux

Fig. 8.

COMPOUNDING DYNAMOS FOR ARMATURE REACTION.

would not coincide with that due to reaction on the dead poles, since the position of the poles with relation to any portion of the moving wire is different at the same instant.

## Speaker Gully and the Story of the Amber Beads.

The WESTERN ELECTRICIAN has not the honor of an exchange list acquaintance with the *Weekly Dispatch* of London, and so it must rely on the English *Electrical Review* for the authenticity of the publication of the following anecdote of the extraordinary magnetism attributed to the recently elected speaker of the House of Commons. The *Dispatch* declares that it heard the doctor himself relate the story, which is summarized by the *Review* in the following terms:

It seemed that a lady suffered from sleeplessness, so when she consulted the doctor [the present speaker] he took her by the hand and very kindly expressed his sympathy; whereupon she immediately went into a sound sleep, which, however embarrassing to the doctor, was so refreshing to her that she begged him to repeat the experiment. Now the lady lived at a distance, so the worthy doctor determined to bridge space in the following way, since he could not hold the lady's hand every evening. He bethought him of the electrical properties of amber, and bought a string of amber beads, held them in his hand for some minutes, and then packed them in a box and sent them to the lady by post, directing her to take them out and hold them in her hand. She sent them back with a letter, telling him that on following his prescription she had enjoyed a good night's rest. Many times the necklace went backward and forward, till one day the doctor received a note to this effect: "Who has been playing tricks with those beads? On taking them in my hand to-day I went into convulsions." The doctor immediately sent for his secretary, and asked him, "What did you do with that parcel I gave you the day before yesterday?" The man colored, and looked uneasy, but said nothing. On being pressed, however, he acknowledged that, seized with a sudden fit of curiosity, he had opened the parcel, handled the beads, and then repacked and posted them.

The fifteenth reunion of the United States Military Telegraph Corps and Old Time Telegraphers' and Historical association will be held at the Broadway Central Hotel, New York, on September 11th, 12th and 13th. An attractive programme is being arranged.

Western Electrician.

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POOR old New York! She would have her contemporaries continue to consider her young, frisky and enterprising, but she still clings to old-fashioned ways and appears to be serenely happy jolting along in horse cars and buses. Even her sister city of Philadelphia has surpassed her and St. Louis has long been far ahead in transportation facilities while Boston, Baltimore, Brooklyn and Cleveland have also left her far behind in this respect. She should take example after Chicago and equip her present horse car lines with the trolley system. Probably the best means of securing this desired improvement is to have New York annexed to some of its neighboring cities. They have all evinced an appreciation of the advantages of rapid transit and would doubtless initiate New York into the benefits to be derived from such improved service. At the present time New York is the only city of the first or second class in the United States depending to any considerable extent upon horse car lines.

SINCE the first announcement of the plans of the Standard Telephone company very little has been published about that concern. Now it is said that negotiations have been pending for the purchase of a controlling interest in the Postal Telegraph company. At first it was the intention to purchase all the stock of the Postal company, but this scheme has failed, it seems, and now an effort will be made to secure the control of the corporation. This would place the new comer in a very advantageous position, as the plant of the Postal company is equaled only by the splendid equipment of the Long Distance Telephone company. It is not positively stated whether any arrangement has yet been completed, but it is known that strenuous efforts are being made to form some such connection as that outlined; in fact, the ability of the promoters of the Standard company to make such a compact was one of the inducements offered capitalists whose support was solicited for the new corporation.

IN removing Amos J. Cummings from the office of subway commissioner, Mayor Strong did more for the city of New York than he probably intended, and he did a real service to Cummings at the same time. The Board of Electrical Control is an expensive institution—a worthless body, whose only excuse for existence is that it supplies jobs for men who have been unable to secure office, but who have nevertheless considerable political influence. When Mayor Gilroy announced the appointment of ex-Congressman Cummings, just before Mayor Strong assumed control, much regret was expressed that the brilliant New York journalist should accept such an office, for while he is a man of remarkable ability, he had no special qualification for the position, and it was recognized that the appointment was in reality in the nature of a pension. His removal has served to call attention to the fact that this board, like other bodies of that kind, is a political institution. We have already called attention to the fact that it was not needed and for that reason should be abolished; now the additional argument is presented in the open acknowledgment that it is looked upon as party spoils.

THE first number of the *Electrical Journal* of San Francisco is out. This is Geo. P. Low's paper, and its pending appearance was mentioned in the WESTERN ELECTRICIAN several weeks ago. It is a monthly, of handsome appearance, and from the quality of the first issue gives promise of being an important factor in the electrical advancement of the Pacific Coast region. The editors—Mr. Low and Dr. Perrine—are to be congratulated.

It is a curious coincidence that this venture and Supt. Barrett's semi-monthly for the students of the National School of Electricity were both projected about the same time, and that for both the name *Electrical Journal* was selected. To add to the confusion, the new comers are strikingly similar in size and external appearance. Mr. Low appears to have been first in announcing the forthcoming appearance of an *Electrical Journal*, but Supt. Barrett certainly anticipated him in actually placing an *Electrical Journal* in the field. Now that both enterprises have been launched, the situation is somewhat complicated. For obvious reasons the conductors of the San Francisco *Electrical Journal* will not care to have their carefully edited review confounded with the *Electrical Journal* of Chicago, while the latter, in its turn, will doubtless wish to be known as a Chicago publication distinctively. To avoid a constant source of annoyance, therefore, it will be well for one of the new journals to change its name; or, if this cannot be agreed upon, let each incorporate a geographical designation in its title, as the *San Francisco Electrical Journal* and the *Chicago Electrical Journal.*

So violent has become the abuse heaped upon the street railway companies of Chicago by the daily papers that very little attention is paid to their comments by the public. It has become the practice of these newspapers to set up a cry of "boodle" just as soon as a petition for a franchise is presented in the council. It would be hard to find in a Chicago paper an editorial on street railway work which does not contain some reference to bribery and official corruption. For instance, in considering the petition for the trolley system on South Clark street, one daily paper said:

Mr. Swift is entirely correct in his belief that the street railway companies can place their wires underground if they wish to; and they will be glad to do so if they find that they cannot bribe a way through for the cheaper overhead abomination.

That is an exceedingly temperate statement considering the subject under discussion and the newspaper in which it appeared. Here is a paragraph taken from a morning paper, more in keeping with the general tone of the Chicago newspapers:

Has it ever occurred to the average elector in a city like Chicago that the worst boodlers are not the men in the Common Council, but without exception are our very "best citizens," our most "prominent citizens," our citizens who are forever prating about their civic patriotism, our citizens some of whom make donations of a thousandth of one per cent. on their illicit profits in jimcracks to the public called works of art? Which is the worse, the poor, ravenous devil of a dirty alderman, or the smug-faced rascally wretch rolling in riches and increasing his hoard by plundering the public?

Has it ever occurred to the editors and publishers of these papers that their duty requires them to lodge information with the grand jury if they have in their possession any proof of official corruption? Otherwise, they should refrain from indulging in such violent denunciation. It cannot be possible that these very scrupulous censors of public morals have been winking at bribery and all the other crimes they charge so freely against big corporations and city officials, although their utterances would lead one to believe they knew of something of the kind. No; we are convinced that it is mere prattle, and very silly prattle, too.

PERUSAL of the annual report of the Westinghouse company cannot fail to convey the impression that that corporation takes a very hopeful view of the situation. This is not due entirely to the company's success in patent litigation during the last year, for if Mr. Westinghouse and his associates on the board of directors read the signs of the times rightly "the demand for electrical apparatus in general will be greater during the next 12 months than for any like period in the past." This is, indeed, an encouraging prospect and it is not to be wondered that the Westinghouse people should feel jubilant as it finds them prepared to handle a much larger business than heretofore by reason of the completion of their new shops. Attention is called to these improvements as well as to the advances that have been made in developing the special form of apparatus with which this company has been identified. The new factory, it is said, is equipped entirely with Tesla motors, and special attention is being devoted to the development of a system for surface and elevated railway lines in which multiphase motors of this type will be employed. A conduit system is also controlled by this company, and the directors feel that the corporation is to day in much better position than ever before in its history. As usual the lighting apparatus department makes a most satisfactory showing, and the complimentary terms in which the president of the World's Fair refers to the execution of the Westinghouse contract with that great enterprise are evidently pleasing to the management. The financial condition of the company is gratifying, the report says, and it must be admitted that the balance sheet affords excellent grounds for this assertion. Taken altogether, the report is a very interesting document, and the officers of the company are to be congratulated upon the exceptionally fine showing that they have made.

ANOTHER interview has been given to the daily papers of Chicago by the city electrician upon the subject of extending the municipal lighting system, in the course of which he says: "All the city electrician asks is the money, and he will attend to the rest." Unfortunately for Chicago, this has been the policy of the department ever since the first steps were taken in this matter. The city has been supplying plenty of money, and the city electrician has been "attending to" its distribution, but it must be confessed that the result of this arrangement is not such as to encourage a continuation of the plan. Would it not be well for the present administration to inquire into this matter more thoroughly than its predecessors have? There is no disposition to accuse Supt. Barrett of having misappropriated funds of the department, but until he has satisfactorily demonstrated his ability to fulfill the promises he made when he induced the city to engage in the present undertaking, his views are not entitled to consideration. He has never successfully controverted the charges made at Cape May; he has never disproved the figures presented on that occasion; he has never been able to explain the process of reasoning by which he arrived at the conclusion that the city lights were being furnished at $73 per lamp per year. Until he clears up all of these matters and explains fully his statements he cannot expect to regain the confidence of the electrical fraternity, and he cannot hope long to retain the confidence of the community. There is not a central station company in the country that would accept such an explanation from its managers as that presented by Supt. Barrett regarding the city plant. There is not a business house in the city of Chicago that would permit its managers to go on for years spending money without accounting for it. At Cape May Supt. Barrett said: "I do not advocate the absorption of a commercial business by any municipality." Again he said: "I do not claim that I can light a lamp any cheaper than anybody else." But in Chicago the city electrician tells the reporters of the daily papers that he can furnish light for commercial as well as municipal purposes much cheaper than private concerns, and he therefore advocates the extension of the present system so as to provide for commercial lighting. The only explanation that can be given for the present movement is that suggested by Mr. De Camp at the Cape May convention, when, commenting upon the facts presented in Mr. Francisco's able and comprehensive paper, he said: "It is known to every man on the floor of this convention who is engaged in the business of electric lighting that municipal ownership of electric light plants has its origin among a few politicians who wish to add another plum to the public pudding." There has been nothing in the history of the Chicago municipal lighting movement to disprove this statement. On the contrary, the entire policy of the department tends to confirm it.

## Substitution of Electricity for Steam in Railway Practice.[1]

By Dr. Louis Duncan.

In an address delivered before this institute in June, 1892, Frank J. Sprague spoke of the coming development of electricity as applied to railways, and outlined his views as to the direction of this development. In the last three years great extensions have been made in electrical transportation, and it seems well to review briefly the amount of these extensions and their direction. In this paper I shall consider electric traction as it stands at present, not the possibilities of the future.

In the last seven years electricity has largely taken the place of horses for tramway work, and it is now beginning to replace cables, although the latter have been recently installed at great expense. At first the lines were confined to the limits of towns and cities, but they have been extended first into the suburbs, and then to neighboring towns, and the extensions have brought them in competition with the steam roads. The reports of the earnings of the railroad companies in the United States show that, after paying fixed charges, only a small amount of the net profit remains to be applied to dividends on the stock. Any general decrease in the earnings, even if it is only a small percentage of the total amount, will wipe out the narrow margin that is now applied to dividends, and the absorption by the electric lines of the local travel formerly conducted by the steam lines promises to do this. At first the managers of the larger steam roads ignored the growth of their electrical rivals, but the time has come when they can no longer ignore the decrease in the receipts from their local passenger travel, and they are beginning to face the difficulty and to carefully study the situation. In this paper I will briefly take up the following questions:

First—Given a railroad system at present operated by steam, will it pay to change entirely to electricity, or to make a partial substitution, and how should the change be made?

Second—If entirely new lines are to be built, is it likely that it will pay to equip them electrically, and how should they be equipped?

Third—I will describe the equipment of the B. & O. tunnel plant and draw from it what morals I can.

In order that it should pay a railroad to make a change in its motive power, the effect of the change must be either to increase the receipts or decrease the expenses by an amount equal to the interest on the cost of the change. That is, there should theoretically be such a gain; practically, the amount should be greater in order to justify the change, to take into account those elements not capable of exact calculation, and also the fact that an increase in the fixed charges of a road is a more serious matter than the mere amount of it, for although the average for a number of years might show a gain by the substitution of electricity, in a bad year the increased fixed charge might cause difficulty.

There are two very distinct sides to the question of transportation, the passenger side and the freight side, and their requirements for good service are very different. First, taking up the question of passenger travel, the receipts of a road are increased by running trains at short intervals and at high speeds, and this is a condition peculiarly favorable to electricity. On an electric line short trains, equally distributed over the track, give a greater station efficiency, and the lowest cost of equipment of both station and line. The cost of train service is somewhat greater, but is compensated by the saving in the other items.

The cost of hauling a given number of passengers between given points by steam is greatly increased when the number of trains is increased. The efficiency is less, and the cost of equipment and of train service is greater. Wellington states that doubling the number of engines for a given traffic increases the cost of transportation about 50 per cent.

On the other hand, if we take up the question of freight traffic the conditions of greatest economy are reached when trains of a maximum weight are hauled by a single locomotive. The tendency in late years has been in the direction of increasing the size of the locomotive, the capacity of the cars and the length of the trains. These changes have necessitated more solid and expensive roadbeds, heavier rails and general strengthening of bridges. The outlay has been enormous, but the decreased cost per ton mile for freight transportation has shown the wisdom of the change. On one of the larger roads, which publishes careful yearly statistics, I find that the cost of transportation per ton mile in 1870 was 1.15 cents and in 1890 .56 cent; on another road it was 1.9 cents in 1864 and .447 cent in 1893. The number of tons per train mile on the first road in 1870 was 103, while in 1890 it was 226. In attempting to carry on traffic of this kind by electrical locomotives operated from a central station, we find that we are at a great disadvantage because of the irregular service necessitated by the freight traffic and the unequal distribution of the load along the line. Suppose, for instance, that there were two stations supplying the line and that the traffic was uniformly distributed along it, then the capacity of each station would be one-half of the total required capacity. Suppose, however, that the entire traffic was concentrated in one train, then each station would have to have a capacity equal to the total power required for hauling the entire traffic, as the train would be first supplied from one station and then from the other. The line also would have to have a capacity suitable for handling the total traffic. If a number of heavy trains were used and the traffic was irregular and liable to be congested at one point, as in the case of freight service, then again the capacity of the stations would have to be greater than that required to supply one-half of the normal traffic. If we were to decide to transmit the current to a longer distance and to supply all the track from one station, using transformer devices along the line, then the capacity of the station itself would only be that required for the normal traffic of the line, but the transformer devices would have to be sufficient to handle the maximum traffic of the section which they supplied and would have to be given a capacity greatly in excess of their average load in order to supply this energy. We must distinctly bear in mind in considering the application of electricity to steam roads that any departure from a uniform distribution of load along the line will increase both the cost of equipment and the cost of operation.

In looking over the reports of the same road from which I have given freight statistics, I find that in 1870 the receipts per passenger mile were 2.09 cents while the expenses were .59 cent. In 1890 the receipts were 1.9 cents while the expenses were 1.47 cents. During this period the passengers per train mile have decreased from 79 to 59. Comparing these figures with those given for freight transportation, we find that the two types of traffic have gone in opposite directions in the period which we have been considering. The amount of freight transported per train mile has more than doubled and the expense has decreased more than one-half. The passengers per train mile, on the other hand, have decreased and the expenses have changed only a slight amount, notwithstanding the greater economies that have been put in force in the interval. Passenger traffic has come in the direction in which electricity is the most economical for transportation; freight traffic, on the other hand, has gone in the direction where electricity becomes most costly. It might be argued that some new scheme for freight transportation by electricity might be used, but it would be difficult to devise any system more economical than that at present in use, and the great amount of through traffic on freight lines precludes the possibility of devising any system which differs radically from that at present in use. For instance, taking the figures from the records of the Pennsylvania railroad for 1893, I find that the freight mileage of foreign cars on the lines of the Pennsylvania road east of Pittsburg is in round numbers 370,000,000, while the freight mileage of home cars is 436,000,000, making almost 46 per cent. of the total mileage made by foreign cars. It would seem, then, impossible to change the present system of freight traffic without disorganizing the service and decreasing the freight revenue of the road. The importance of freight traffic is shown by the fact that the earnings from freight on all the roads in the United States is between two and one-half and three times as great as that for passenger traffic. The New York Central Railroad company in 1892 received from freight traffic $26,000,000 and from passenger traffic $13,000,000. On the lines of the Pennsylvania railroad east of Pittsburg, the freight receipts were $47,000,000, as against $17,000,000 for passenger receipts.

Suppose, then, the question comes up before the managers of a road whether they are to equip their lines to be operated entirely by electricity. It seems to me, as matters now stand, it will not pay trunk lines to change the method of operation for freight traffic, and the question to be considered would be the operating of the lines partly by steam and partly by electricity. Let us consider if it is possible to run the passenger service wholly or partly by electricity. Considering a two-track road doing a through, as well as a local business, I think we can decide that unless the case be an exceptional one, it will not pay to equip the main line electrically. It is necessary that the through express service be continued, and that the freight service be continued, and an attempt to operate the local trains with the through trains could not be successful if there was any considerable amount of through traffic. With a four-track road the condition of affairs is somewhat different. If the road operates between cities acting as terminal points for all passenger traffic, as with some of the lines between Boston and New York, then by equipping all four tracks it would be possible to run express service at short intervals on two of the tracks, and on the other two tracks to run freight and local trains. At present it would not pay to use electric locomotives operated from a central station for the freight service, but the local service could be operated electrically, and as the speed of the local trains would be approximately equal to that of the freight, there need be no serious interference with the traffic. We would then have express passenger service working under favorable conditions, that is, with a number of trains evenly distributed; a local service operated under similar favorable conditions, and with no interruption to the freight traffic. If the road, however, is to transport a considerable number of foreign cars, as, for example, the New York Central or the Pennsylvania railroad, then the condition of affairs for express service would not be so favorable, and the question of the equipment of the tracks for express service would have to be carefully considered. As far as the branch lines go, whether it would pay to partially or wholly substitute electricity for steam depends upon the local conditions. A long branch, with a small amount of local traffic, would not pay to equip, but on a short branch with considerable passenger traffic and comparatively little freight traffic, such equipment would pay. I find that in 1892 the total number of through passengers carried by the New York Central road was 234,650, while the number of local passengers was 21,978,979. It will be seen that the through traffic is but a small percentage of the total number of passengers, and that the question of preserving the local traffic is of great importance. Now, the greater part of this local traffic will, in the next few years, be taken by the electric roads paralleling the steam road unless some effort is made either to control the electric roads or to give an equally good service between adjacent towns. This latter is possible, using the ordinary steam tracks, only when the distances between towns are small and the amount of freight or through traffic is also small.

There are certain kinds of local traffic which the steam roads must, to a large extent, lose, and which, in the nature of things, they cannot regain. In large cities having a considerable suburban traffic the trolley roads, forming, as they, do a network of lines within the city, and extending in every direction into the suburbs, offer advantages with which the steam roads cannot compete. In Philadelphia one of the large steam lines lost so much traffic that it has attempted to regain it by reducing prices and increasing the number of trains. In this effort it has partly succeeded, but at the cost of greater expense and decreased receipts. To counterbalance this loss at central points railroads may hope, by the introduction of electricity, to increase their earnings along the lines and on their branches.

As to the nature of the equipment that will be required, it would depend on the work to be done and the branch that is to be equipped. In some cases it might be well to use single electric cars running on the steam tracks between towns and on the local tram lines in the towns. As the speed would be very different in the town and on the railroad line, and as the voltage could also be different, it would be well in this case to use a number of motors on the car, and to use a series parallel controller, the motors being in series for the town traffic. For instance, suppose we wish to run at a maximum speed of forty miles per hour between two towns, and it is economical to use 1,000 volts on the line, we could use two motors on the car, run them in parallel on the main line at a speed of forty miles an hour, while in town, with a voltage of 500 we could run them in series at a speed of 10 miles per hour. I can hardly imagine a case where the three-wire system could be economically used for such service on the steam lines.

The condition of affairs in electric transportation is at present curious. The trolley companies, by extending their lines, are working from tramway transportation to through transportation. They are attacking the problem by development from small motors to larger ones. The railroad companies, starting with the large units, are coming down in the direction of the present trolley systems, as in the case of the Nantasket Beach road of the New York, New Haven & Hartford company. Perhaps in the future they will meet and some standard electrical system will be adopted for the present steam road. I think, then, that in the case taken up, the policy of the road will be to equip those branches for which the conditions are favorable with a trolley, run comparatively large motor cars capable of drawing one or two ordinary passenger of freight cars as trailers, using the present steam service for their freight traffic when necessary. This will allow the necessary through travel, will give the required local service between towns, and will not interfere with the freight traffic.

As for the systems to be used for such services, I believe that at the present moment the continuous current overhead trolley system is the only one that can be selected with a certainty of successful operation. It gives a minimum complication in the way of conveying the current to the cars, it allows a considerable range of speed with a comparatively high efficiency, and our experience with it is such that successful operation could be at once guaranteed. By using different voltages in the towns and on the line, both high and low speeds can be obtained. If the line to be operated is to be very long, it might be best to use rotary transformers at different sub-stations along it, the line being supplied by continuous currents from the sub-stations. In fact, the three systems that are at present possible are: First, the ordinary direct current system; second, a system in which direct currents are used on the line and rotary transformers supplied by alternating currents are placed along it, and third, a two or three-phase system supplying rotary field motors on the cars. In the latter case, it would be well to employ different periods in the towns and on the lines.

The second case which I wish to consider is that of roads built for an entirely new electrical equipment, such, for instance, as the elevated roads in Chicago, and the underground rapid transit road in New York, or the proposed Washington-Baltimore Boulevard line. In most of these cases the traffic is almost entirely a passenger traffic, and the conditions are especially favorable for the operation of electricity. Taking first the case of the New York underground road, there will probably be required about 150 trains for local service, each train having five ordinary cars and a motor car. For the express service there would be about 25 trains of, say, four ordinary cars with a motor car. For this, it would probably be best to use the direct current three-wire system, one of the cars on the train being equipped with motors and acting as a locomotive. With four motors on a car the system would be efficient at all practical speeds, and if desired, a large part of the energy could be thrown back on the line when the cars are being stopped. In the case of the local trains a simple calculation will show that a very small part of the total energy expended is used in overcoming the track resistance, while a very considerable part is employed in accelerating the train and afterward wasted by braking. I have calculated the amount of energy which can be practically saved under the conditions of local and express traffic on the New York underground road, and find that with motors of ordinary efficiency about 45 per cent. can be returned. If storage batteries are used in connection with the central stations, the batteries being located along the line, a uniform load can be thrown on the stations, and their capacity may be reduced to almost one-half as compared with a system in which the energy is not returned, thus greatly decreased both the expense of installation and of operation. As it is possible at present to obtain batteries with a rapid discharge rate at very reasonable prices and with a guarantee for repairs that place them well within the limit of commercial calculations, a system of this kind offers some advantages over any other system that could be applied to the operation of the underground road. An alternating current would hardly be economical for this work, as it precludes the possibility of returning the energy to the line, and as the variable speed required makes it uneconomical as compared with the direct current system using, say, four motors with series parallel control. In the case above cited, shunt motors would be used, and it would be possible to get a contact with the line that could not under any circumstances be broken. The case of the elevated roads is very similar to the one I have cited, except that in existing structures shorter trains would be used, and the cost of equipment for a given number of cars would be somewhat greater.

Baltimore has been the pioneer in almost every branch of transportation. In ocean service, the record of the Baltimore clipper is a tradition of our maritime supremacy. The Baltimore & Ohio railroad was the pioneer steam road. An electric road from Baltimore to Hampden, built in 1885, gives us a right to boast of our pioneer work in electrical tramways. The immense locomotive for the Baltimore Belt line tunnel is the first instance of the direct displacement of steam by electricity, and the line over which it is to be oper-

1. Inaugural address delivered at the general meeting of the American Institute of Electrical Engineers, Niagara Falls, June 25, 1895.

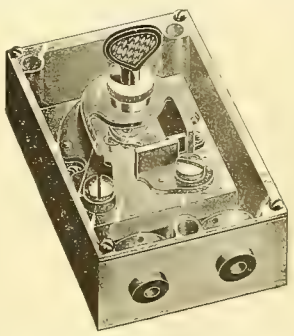
ated is the first through steam line to be equipped electrically. The Baltimore & Columbia Railway company owns in Washington the Eckington and Soldiers' Home railroad the Belt Line railroads and has franchises for extensive additions to their present mileage. In Baltimore they are constructing a road in the city and beyond it to Ellicott City, and they have also purchased a steam line running from Baltimore to Catonsville. They have rights of way from the terminus of their Baltimore lines to the lines they own and are preparing to build in the District of Columbia. The problem offered is not a simple one, but it is one of the most attractive that can be presented to electrical engineers. Speeds of 60 miles per hour are to be used for the cars outside of the city limits, and within the city limits ordinary speed is to be employed. In the District of Columbia overhead trolley lines are not allowed and some type of conduit will have to be employed. In fact there is presented almost every problem which must be solved if electricity is to displace steam in the future with the same rapidity that it has done in the past. Many high speed electric roads have been projected, a number of them occupying considerable space in the newspapers, but I think this road will be the first to solve the detailed problem of interurban rapid transit.

The last subject which I wish to take up is the electric plant for the Belt line tunnel of the B. & O. railroad. In this case there is no question of economy in the employment of the electrical locomotives, as the plant adds considerably to the cost of operating the road. The Belt Line tunnel runs beneath the city of Baltimore for a distance of 1¼ miles, then to the outskirts of town through open cuts and short tunnels. There is a grade of .8 of 1 per cent. over almost the entire length of the tunnel proper, while one-half mile beyond it there is a grade of 1½ per cent. Being in the middle of town it would have been difficult to have provided a satisfactory ventilating plant, even supposing that ventilating plants had been successful in other localities, which is not the case. The managers of the B. & O. Railroad company wished to provide a satisfactory service, and considered a number of plans for drawing their trains through the tunnel without the annoyance due to smoke and gases. After careful consideration they concluded that electricity was the most satisfactory means to accomplish this, and the General Electric company was confident enough of its ability to successfully equip the road to make a contract with the B. & O. company to haul its trains over the Belt Line, the contract being dependent upon the successful operation of the plant. The total length of the line equipped is about three miles, the extension beyond the tunnel being for the purpose of assisting the freight locomotives to haul their trains up the 1½ per cent. grade on the line, beyond the tunnel. There are to be three locomotives and it is calculated that the traffic can ordinarily be handled by two of them. The steam engines are not to be taken off the train, but hauled through the tunnel by the electric locomotive which switches off at the terminus of the line. To operate these machines, a station has been erected which contains 3,000 horse power of electric generators, and an overhead line has been equipped to transmit the current to the locomotives. With respect to the station itself, there is little that is novel. There are four 750 horse power Allis-Corliss engines directly coupled to generators of the same capacity, the generators having a voltage of 600 at no load and 700 at full load. The foundations have been partly erected for a fifth unit in case it is found necessary. The building also contains a lighting plant having a capacity for 400 arc lights and 4,000 16 candle power incandescent lights. Provision has also been made for an extension to this lighting plant when the stations for the Belt Line are erected. There are two incandescent machines and one of them will be used to supply the 1,000 32 candle power lamps which have been installed in the tunnel. Perhaps the most novel feature of the plant is the overhead structure that is employed. The conditions to be met were peculiarly difficult, and the ordinary underrunning trolley was considered impracticable. The tunnel is very low in places and the management of the road decided that the conductors could not be placed over the cars, but should be placed in the middle of the tunnel between the tracks. Outside of the tunnel the conductor is still between the tracks, but is elevated to a height of 22 feet, while inside of the tunnel it is only 17 feet from the top of the rail. The conductor consists of an iron trough made of two Z-bars riveted to a cover plate 12 inches wide, leaving a slot one inch wide between the Z-bars. In the tunnel this trough is supported from transverse channel bars secured to expansion bolts, which are fastened in the top of the tunnel. There is a double insulation, one porcelain insulator being between the trough and the channel bars, and another between the channel bars and the expansion bolt. Outside the tunnel the trough is supported as follows: At distances of 150 feet light iron columns with cross trusses are erected, and between these trusses are hung catenaries supplied with a number of suspension bolts. Transverse channels similar to those used in the tunnel are fastened to these bolts, and the trough is fastened to the channels. The Z-bars are made in lengths of 30 feet, the opposite bars breaking the joints with one another, the lengths being riveted together and then bonded with Chicago rail bonds. Suspended on the same transverse beams as the trough are three copper cables of 1,000,000 circular mils area which serve as feed wires and which are connected at intervals with the trough, there being, of course, one trough for each track. For the return circuit the tracks are bonded as in ordinary railroad work, there being cross bonds and at intervals connections with a copper cable of 1,000,000 circular mils area carried in a wooden trough between the tracks. The contact arrangement that is to be used consists of a brass shoe traveling in the trough and connected with the locomotive by a flexible saw-buck arrangement which has a very considerable range in every direction. The current is transmitted to the motors by a copper cable, and in case of the shoe sticking in the trough, a safety pin is arranged to break with any desired strain. Where switches are used there is a tongue worked by the lever which operates the track switch, and which serves to direct the shoes. This structure, although exceedingly massive and expensive, promises to give an excellent contact at all times, and it requires no care from the motorman.

The locomotives are the most massive in the history of either steam or electrical transportation, and the weight, which amounts to 95 tons, is on eight driving wheels, so that the full tractive power of the locomotive will be developed. On each axle there is sleeved a six-pole motor, there being considerable play between the axle and the sleeve, which latter is spring supported from the frame. In this way any heavy blow due to irregularities in the track is taken through the springs and the wear both of the track and locomotives is reduced. On the armature shaft are projecting arms which move between lugs cast on the wheels, thus allowing the necessary relative motion between the axle and armature.

The situation in the Baltimore Belt Line plant is this: The station is completed and is being operated daily. One of the locomotives is on the ground set up and ready to run, and the overhead work is finished with the exception of a short length which was interfered with by a temporary bridge over a cut. The latter has been removed, and the plant should be ready to run this week.

If this equipment proves successful it will open a limited but important field for the introduction of large electric



BRYANT MARINE SWITCH.

locomotives. There are in the United States a number of tunnels whose operation is anything but satisfactory at present, which can be equipped as the Baltimore tunnel is equipped. Several of them have the additional advantage that they are near the switching yards of the roads, and the same plant could be used for hauling trains through the tunnels and for switching, and not only would the economy of the station be increased, but the substitution of electric for steam switching engines would result in a very considerable saving.

This is the last of the subjects that I proposed to consider. In this paper I have not indulged in prophecy, nor have I imagined any apparatus or equipment which cannot be bought to-day in the open market. But to me it seems that the present is a crisis in the history of railroading. Up to the present the steam roads have ignored the competition of electric roads, or they have fought them. To-day they cannot afford to do either. In a few years electric roads will have absorbed practically all of the local traffic and will begin to cut into through transportation. The steam roads cannot afford this and their only safety is to make of electricity an ally instead of an enemy, and this before it is too late. The conclusions that I finally reach are these:

First—The tendency of passenger transportation on the steam lines has been in the direction of the greatest electrical economy, while the tendency of the freight transportation has been in the direction of the least electrical economy.

Second—It will not pay any through line with considerable traffic, having two tracks, to equip the main tracks electrically.

Third—With four-track roads it will pay to equip all of the tracks electrically, unless a considerable portion of the business is through passenger traffic.

Fourth It will pay all the larger roads either to equip a number of their branch lines electrically or to control competing electric lines.

Fifth—In order to remain on a dividend-paying basis it is imperative that most of the two-track lines either build additional tracks or control the electric railroads that parallel them.

Sixth—Believing that ultimately all of the traffic will be done by electricity, it is imperative that the managers of steam roads keep constantly in touch with electrical progress.

## Marine Lighting Plant on the Bay State.

The accompanying engraving represents the electric lighting plant on the new steamer Bay State of the Boston and Portland line, recently installed by the Belknap Motor company of Portland, Maine. This equipment is duplicated on the steamer Portland of the same line and also on the steamship St. Croix now being built for the International Steamship company.

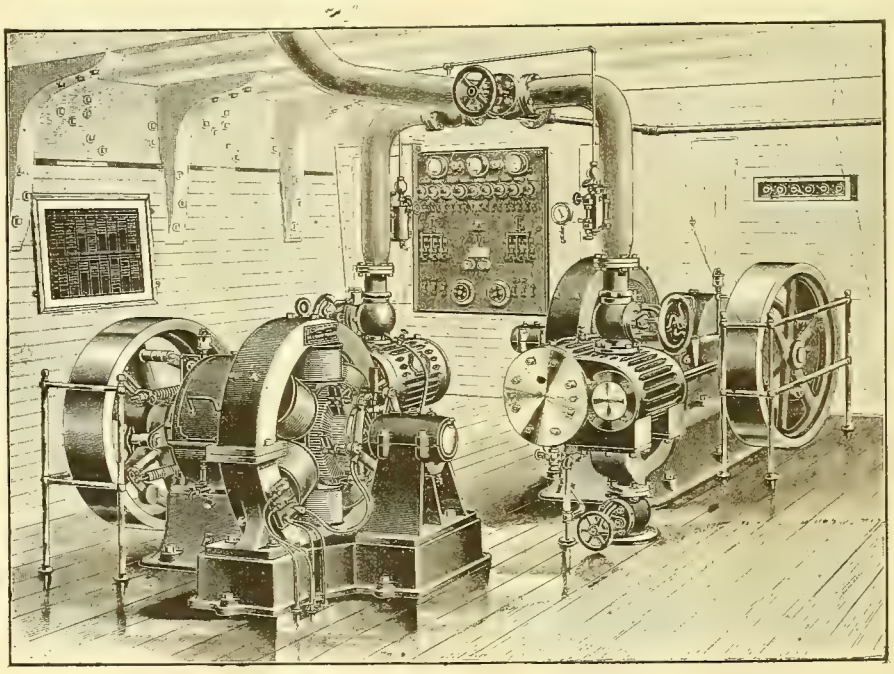
The engines used are the Ideal. The dynamos are multipolar slow-speed machines of 400 lights capacity each, but either machine will carry the entire load, amounting to 540 lights. It has become a general practice to use duplicate plants for marine work, so that in case an accident should happen to either engine or dynamo, the duplicate machine can do the work. This plant does credit to the Belknap company and has secured for it the installation of the two other ship lighting plants mentioned.

The wiring was done under the direction of Elmer E. Emmons, one of the most expert workmen in this line in the New England states. Eight main circuits, controlled at the switchboard in the dynamo room, lead to sixteen different distributing boxes, located in different parts of the boat. These distributing boxes have glass fronts secured with lock and key and are under the control of the steward of the boat.

The fixtures are of the latest design, with opalescent globes and shades. The dining saloon is fitted with ground glass globes, which gives this part of the boat a very cheery and pleasing effect. The freight deck is supplied with guarded fixtures. The boat at night presents a brilliant spectacle, being a veritable floating palace and surpassing in its appointments anything that can be found in eastern waters, the Sound lines only excepted.

## Bryant Marine Switch.

The two American steamships, the St. Louis and the St. Paul, recently built by Cramp & Sons of Philadelphia, were equipped with black china switches and a new marine switch furnished by the Bryant Electric company. The Bryant marine switch, which is herewith illustrated, has a metal box with openings for the wires, protected by bushings of porcelain or hard rubber. In the interior is a Paiste switch, mounted on a porcelain base. This switch is without doubt admirably fitted for certain classes of marine work, and may be of service in other places as well. Thos. G. Grier and Edward R. Grier, the western representatives of the company, will be prepared to ship these switches from the Bryant Electric company's western office. The switch is made for 10 amperes capacity.



MARINE LIGHTING PLANT ON THE BAY STATE.

## Chicago Council Votes for Down-town Trolleys.

By a vote of 41 to 6 the Chicago City Council decided on Monday to grant a franchise to the Chicago City Railway company, permitting it to erect a double-track overhead trolley line in Clark street, from Washington to Twenty-second street. This is mainly in the down-town district, and an unsuccessful effort was made to prevent the road from going north of Van Buren street. The only change from the company's ordinance, however, was that it should change the trolley into the underground system when practicable.

The new routes given the company by the ordinances are as follows:

In Forty-seventh street, connecting with the tracks of the company west to Archer avenue; in Kedzie avenue, from Thirty-eighth to Sixty-third streets; in Archer avenue, from the tracks of the company west to Fifty-first street; in Western avenue, from Archer avenue to Seventy-first street; in Sixty-ninth street, from the tracks of the company west to Western avenue; in Twenty-ninth street, from Butler to Wallace; in Thirty-eighth street, from the present terminus west to Central Park avenue; in Fifty-ninth street, from State to Western avenue; in Forty-seventh street, from the Illinois Central to Cottage Grove avenue.

The following horse car lines are to be operated by electricity:

Archer avenue, from the river to State street; Clark street, from Washington to Twenty-second street, west to Wentworth avenue and south in Wentworth avenue; Ullman street; Halsted street, from O'Neill to Archer avenue; Twenty-second street, from Indiana avenue to the river; Dearborn street; Thirty-fifth street, from State street to Cottage Grove avenue.

Aldermen Mann and Kent protested against a franchise being given the company to extend its Forty-seventh street line to the Illinois Central tracks. They said they had heard that a majority of the property owners had not signed the petition. They said that they had also heard that some of the signatures of the petition had been forged. The council was asked to refer the ordinance back to the committee, that these charges might be investigated, but Alderman Hepburn told the council that the petition showed an excess of 405 feet, and the ordinance was passed.

## Demand for Elevated Electric Roads in Chicago.

[From the *Chicago Evening Journal.*]

If Chicago wants surface electric lines in down-town streets it can have the best kind instead of the worst. It is only a matter of demanding it. It is too much to hope that the city can secure any share of the profits from such an enterprise, but Mayor Swift can, and we doubt not will, refuse to admit the cheaper and more dangerous system merely that the street car company may make money at the expense of lives and property.

But the mayor should go one step farther, as he seems inclined to do, and realize once for all that the era for surface rapid transit in Chicago has long since passed, and that the electric grade crossing must go just as surely as the railroad grade crossing. One is fully as productive of fatalities as the other.

Elevate the electric lines, Mr. Mayor. Nothing else can be just to the people. Nothing else can ever give Chicago rapid transit with safety for life and limb.

## Autopsicution Suggested Instead of Electrocution.

[From the Rochester *Post-Express.*]

At 11:21 the electric current was turned on and the murderer, Buchanan, received the full force of 1,740 volts for four seconds and then 400 volts for 30 seconds. He was examined hastily by the physicians. There was the usual gasping; but there was also a faint pulsation of the heart; and the current was turned on again at 11:22½ at full force for 23 seconds. Buchanan was then pronounced dead, and the autopsy began at 11:30, or nine minutes after the first shock was administered. The physicians present unite in declaring that the murderer was killed instantly by the first shock. It is now the opinion of the best authorities on electricity that such a shock as the murderer received may not mean death absolutely, but suspended animation. The case of Grover in this city is a clear illustration. He received a heavier current than Buchanan; he was apparently dead for nearly an hour; and he was resuscitated after persistent and carefully conducted effort. Buchanan was on the dissecting table within 10 minutes, and naturally the doctors prefer to think electricity killed him. No man with any respect for facts will deny that he is dead now, though probably he was not dead after the first shock and possibly he was not dead after the second. When the new law went into operation there was some discussion as to the proper term to apply to death in the chair, and it was finally called "electrocution." As there is every reason to suppose that it is not electrocution at all, we propose a change. Let it be called "autopsicution."

On July 1st the Detroit Citizens' Street Railway company filed a $7,000,000 blanket mortgage, covering its property, to the New York Security & Investment company. It is what is called a consolidated mortgage, and is made to cover all the company's indebtedness and for the continuance of its work of equipping the lines with electricity.

## Westinghouse Annual Report.

Following is the annual report for the year ended March 31, 1895, of the Westinghouse Electric & Manufacturing company, dated July 2d, and signed by George Westinghouse, Jr., president:

The all-important feature of the year's business has been the creation of a magnificent workshop, having unequaled facilities for the carrying on of the business in which your company is engaged, and the concentration therein of the manufacturing operations formerly conducted under great difficulty in three widely separated works, with material stored in numerous warehouses.

These new works, located at East Pittsburg, about 12 miles east of Pittsburg, are extensive and exceptionally complete in every detail necessary to the production of the best class of apparatus at the lowest possible cost, and will thus insure to your company many advantages. These new works were erected during a period of exceptionally low prices for labor and material, and under other favorable circumstances, so that the cost shown in the accompanying balance sheet is greatly below earlier or present prices for like work.

As was to be expected, such extensive building operations and the removal of materials from the old to the new works reduced the output for the year to about three-quarters of what it would have been without the interruption and extra work entailed.

The annual meeting of the stockholders of the company was adjourned at the regular date, May 15th, to July 17th, as the transfer from the old to the new works had not at the earlier day been fully effected, it having proved far more difficult and complicated than your directors had anticipated. They are glad to be able to announce that it is now completed, with results which promise to be most satisfactory in the immediate future of the company. It was the desire of the board that at the annual meeting every opportunity be afforded the stockholders to see for themselves what had been accomplished, and so form their own opinions of the efficiency of the plant and the value of the property. This was not possible in May; it is possible now. The directors therefore earnestly invite all holders of the company's stock who may be able and desire so to do, to attend in person the annual meeting on July 17th at Pittsburg, where special railway and other arrangements will be made. Meanwhile, the directors feel justified in saying that the works are as nearly perfect as they could now be made, and are now operating to the entire satisfaction of those in charge, and that the production has already been increased to a point where the demands of all customers can be promptly met, and there now seems to be no reason why your company should not in the near future be as large a producer of electrical machinery as there is in the country.

In anticipation of the increased facilities which your company would have in its new shops, a large amount of time and energy were put into the development of new and better forms of apparatus for the trade, and this extra work, together with that incident to the preparation necessary to occupy the new quarters, increased the general and extra expenses to a figure somewhat above that of the year ending March 31, 1894.

So far as ascertained there was expended directly in removing the machinery and material $90,499.54, after deducting which from the earnings from business and other sources, there is left a net profit of $711,909.68.

This, also, it must be borne in mind, was the outcome of a business year during which, for reasons already stated, your company was working under conditions as to output, which, in the opinion of your directors, were so unfavorable that the net results scarcely represent half of what might reasonably have been expected under ordinary circumstances.

### LIGHT AND POWER PROPERTIES.

Your company has for the last six years been interested in two important light and power properties, namely, the United Electric Light & Power company of New York and the Brush Electric company, Baltimore, Md. During the last year both of these companies, with the assistance of your company, have carried through financial plans which have put them on a prosperous business basis, and have given a large increase to the value of their securities held by your company.

The United Electric Light & Power company, under the plan referred to, has acquired almost all of the stock of the Brush Illuminating company and of the United States Illuminating company, both of New York city, and is now completing and will soon have in operation one of the most comprehensive light and power stations in the United States. It has contracted with your company for 10 complete electrical outfits of 1,000 horse power each, and for all the converters and other needed apparatus, half of these outfits having been used for the World's Fair lighting. On the completion of the contract your company will have in securities of the United company: First mortgage bonds, $913,000; preferred stock, $550,400; common stock, $411,700; having already received of the amount, under the terms of the reorganization, for material, unsecured notes, claims, and for a cash subscription of $200,000, first mortgage bonds, $548,000; preferred stock, $187,500; common stock, $411,700. From its old stations this company is now doing a business of about $800,000 per annum, which should be more than doubled by the revenue from the output of the new station, giving it a net revenue sufficient to pay interest on its bonds and dividends on all of its stocks, there now being a demand for light and power sufficient to absorb the entire capacities of the stations of all existing companies.

In the reorganization of the Brush Electric company of Baltimore, Md., your company subscribed for $40,000 first mortgage 5 per cent. bonds and took in payment for machinery $170,000 first mortgage 5 per cent. bonds, making your company's total holding $210,000 first mortgage 5 per cent. bonds. Your company also was the owner and now holds 5,060 ($100) shares of the common stock out of a total of 7,292 shares outstanding.

The station of the Baltimore Brush company is new and is one of the finest to be found in the country. It has three of the World's Fair 1,000 horse power engines and generators and has been supplied with a large amount of other electrical apparatus and will be hereafter, as will also the United company, a constant purchaser of your company's apparatus and supplies.

The fields of operation of these companies are unusually profitable ones, and it is believed by your management that the value of the securities of both properties will, in the near future, be equal to or above their par value (amounting to $2,591,100), and that the final profit to your company on these securities will be a large one.[1]

Outside of the profit your company will make from its interest in the United Electric Light & Power company of New York and the Brush Electric company of Baltimore, your management anticipates a great addition to its business from the experience gained with these two companies and others in building light and power stations throughout the country and the rebuilding on like lines of many antiquated plants, the managers of which are rapidly being forced to the conclusion that they can only continue to have a profitable business and successfully meet any competition that may arise by using multiphase alternating current generating apparatus directly connected with engine shafts, whereby Tesla motor and all other services can be had from one class of machinery.

As stated in the last report, your company "has no contracts of any character with local lighting or other companies which can in any manner interfere with the sale of its apparatus."

The final closing of the World's Fair contract, and the cancellation of all the bonds given by your company for the faithful carrying out of the work, in connection with the profitable sale of the machinery used there, will make the following letter received from the president of the World's Columbian Exposition, H. N. Higinbotham, of interest to stockholders:

It is with great pleasure that I hereby acknowledge the important work performed by your company in and for the World's Columbian Exposition.

Your company installed in Jackson Park fourteen (14) dynamos, having a total capacity sufficient for operating 188,000 16 candle power lamps; these dynamos operated both incandescent and arc lamps, as well as small motors, the entire capacity being equivalent to over seventy-five thousand (75,000) 16 candle power lamps. Your company installed this plant complete, including distributing system, as well as inside wiring.

Your contract required you to install, operate, maintain and remove your machinery; the task undertaken was one of great difficulty, as you were frequently delayed by the contruction of other buildings and underground work by other contractors not being prompt in the execution of their contracts. The latter was done under very unfavorable conditions, owing to inclement weather, and the inside wiring was done hastily, as the position of lights could not be determined until shortly before the opening of the exposition. Notwithstanding all these difficulties, the result of your work was fully up to our expectations and the requirements of your contract; and I take pleasure in certifying to the fact that the World's Columbian Exposition were in every respect fully satisfied, not only with the plant, but with the work performed, and the uniform gentlemanly and courteous treatment received at your hands as well as from your subordinate officers.

For this work I beg you to extend to your company the thanks of the exposition management, as well as my own personal acknowledgement for the many courtesies received at your hands.

### COLLATERAL TRUST BONDS.

After full consideration of the subject, your board, under the powers conferred upon it by the company's charter, has authorized the issue of $1,250,000 ten year 5 per cent. collateral trust bonds, secured by certain bonds and stocks held by the company, provision being made in the deed of trust for the sale of a portion or all of the securities, and for the cancellation of the corresponding amount of the collateral trust bonds secured thereby. It is proposed to fund out of the proceeds of this issue of collateral trust bonds an equal amount of debt, a greater part of which has been created in the building of the new works, the purchase of new machinery, and the outlays in connection with the financial plans of the United and Brush companies.

### WESTINGHOUSE ELECTRIC COMPANY, LIMITED.

Your company during the past year sold additional patent rights to the above company, and with the proceeds purchased the preferred and common stock of a number of English holders, so that your company now owns $782,500 preferred and $1,307,400 common stock (together, $2,089,900) out of $2,322,750 outstanding, and your company will hereafter direct all of its affairs. All apparatus sold by the London company has been purchased from your company at profitable rates, and the business of the London company has always been profitable, last year having netted nearly 5 per cent. on a valuation of $1,000,000. It is proposed to push the business in Great Britain, continental Europe, and in the various colonies, in order to increase the sales of your company's product, there having been many inquiries during the year which your company has been unable to respond to, owing to lack of manufacturing facilities.

It is believed that the new prices which we have been able to make to the London company will enable its management to largely increase its sales and give a permanent value to all of your stock in that company.

### PATENTS AND LITIGATION.

Your company, through its able counsel, has been successful in favorably terminating the litigation in respect to incandescent lamps, the feeder and main, and other important patents, and it was especially successful in the celebrated Bate Refrigerator case before the Supreme Court, in which the life of a number of patents, which were being used to influence trade by your adversaries, was finally determined.

In the McKeesport case, argued in the Supreme Court, October last, involving the ownership of the carbon burner for incandescent lamps, no decision has yet been handed down, but the long delay on the part of the court in arriving at a conclusion is regarded as not unfavorable to the sustaining of the claims of our Sawyer-Man patent.

To-day the most important inventions are those relating to the use of alternating currents, and your management

1. The profitable character of the light and power business in large cities is indicated by present prices of the common stocks and bonds, which mostly are selling at a large premium.

believe that, with the exclusive control of the Tesla patents, its position in patent matters is more favorable than that of any or all of its competitors.

STREET RAILWAYS OPERATED BY UNDERGROUND ELECTRIC CIRCUITS.

Your company has secured the controlling interest in the stock of the Electro-magnetic Traction company of West Virginia, and through it the control of valuable inventions relating to the operation of street railway cars in large cities by means of underground circuits.

This system has been in continuous operation in Washington during the last year, and is now in successful operation on the tracks of your company in and about the buildings at East Pittsburg, where it is to be used for moving freight cars and for general work.

This arrangement appears to be a complete solution of the problem of street car propulsion in all large cities, and should give to your company a large amount of additional business.

A model of this system is now in operation at our office at No. 120 Broadway, New York city, and will be exhibited to stockholders between the hours of 10 A. M. and 4 P. M. during July.

TESLA POWER DISTRIBUTING INVENTIONS.

Your company owns the exclusive right to manufacture and sell apparatus under the patents of Nikola Tesla, covering the use of multiphase alternating currents for power distribution. The rights under these patents are of great value, for developments indicate that it is only by means of Tesla's inventions that elevated and long lines of railways can be successfully operated, and that power can be most economically distributed over wide areas, and throughout workshops. All of the machinery in your company's new factory at East Pittsburg is driven by Tesla multiphase motors, and in such a successful manner that orders for like apparatus have followed its inspection.

The 5,000 horse power generators contracted for by the Niagara Cataract Construction company have been put in successful operation, and other important installations for power transmission under the Tesla patents have been made in various parts of the country.

Recently your company has fitted a short branch of the Pennsylvania railroad with ordinary electrical apparatus for the propulsion of standard cars, and the tests have been entirely satisfactory. Your company is, however, pushing forward the manufacture of multiphase motors under the Tesla patents for practical tests in running standard cars on elevated roads and long lines, the success of which will be of especial importance, for it will insure to your company a large amount of trade for which your rivals will have no right to compete.

Suits under the Tesla patents are pending against the Stanley Electric Manufacturing company of Pittsfield, Mass., and the Thomson-Houston company. In the latter case, on application made by attorneys of your company, the defendants have been limited to the 7th of October within which to close their testimony, it being the intention of counsel to push this and all cases of infringement to a hearing in order that your company may enjoy the exclusive privileges to which it is entitled.

While heretofore a very large percentage of the business of the country has been done by means of apparatus using continuous currents, it is now estimated by experts that the percentage will change so that in the near future the bulk of the business will be done by means of alternating current multiphase apparatus, involving the use of Tesla's important inventions.

CAPACITY OF NEW WORKS.

Our present room is sufficient for the employment of between four and five thousand men. The various buildings have been so arranged that the main workshop can be readily extended and the capacity of the works doubled at a comparatively small outlay without interference with regular manufacturing during building operations. Outside of the main buildings the others already have the required capacity, and there is still available for further buildings full one-half of the forty acres owned by the company.

The indications are that the demand for electrical apparatus in general will be greater during the next twelve months than for any like period in the past, and it is therefore a matter of great importance that our new works are now in complete operation.

BALANCE SHEET.

Following is the balance sheet for the year ended March 31, 1895, which is appended to the report:

ASSETS:

| | | |
|---|---|---|
| Cash in banks | | $202,880 89 |
| Bills receivable | | 80,133 81 |
| Accounts receivable | | 2,146,131 10 |
| Material in stock and in process of manufacture (at cost of labor and material) | | 2,120,227 95 |
| Advances to leased companies | | 149,588 20 |
| Bonds (par value $366,206.17) | | 811,271 38 |
| Stocks (par value $8,656,090 72) | | 4,092,319 40 |
| Real estate and buildings, Pittsburg | | 464,403 48 |
| New factory—Land and buildings | $1,186,759 22 | |
| Less—First mtg on land and bldgs. (final payment due April 1, 1900) | $400,000 00 | |
| Second mtg. on land. (final payment due April 1, 1896) | 115,000 00 | |
| First mtg. second purchase land (due July 1, 1895) | 59 300 00 | 574,300 00 |
| Total | | 612,459 22 |
| Machinery and tools | | 1,159,842 44 |
| Miscellaneous | | 70,292 77 |
| Charters, franchises and patents | | 4,404,499 45 |
| | | $16,314,241 09 |

LIABILITIES:

| | |
|---|---|
| Accounts payable | $403,017 02 |
| Bills payable, issued for merchandise | 379,222 36 |
| Discounted with collateral | 1,265,000 00 |
| *Contract and Contingent Liabilities:* | |
| Scrip dividend | 194,560 00 |
| Stock subscription | 13,125 00 |
| Collateral trust bonds | 250,000 00 |
| U. S. Elec. Ltg. Co.'s 6 per cent. 15-year bonds $50,000 payable annually | 500,000,000 |

(Bills receivable under discount $396,972.37.)

*Capital Stock:*

| | | |
|---|---|---|
| Preferred, 79,865.31 shares | $3,993,265 50 | |
| Assenting, 103,779 02 shares | 5,188,951 00 | |
| Common, 2,954 shares | 147,700 00 | |
| | | 9,329,916 50 |
| (In treasury 13,266.98 shares assenting and 134.69 shares preferred.) | | |
| Surplus | | 3,979,400 21 |
| | | $16,314,241 09 |

SURPLUS.

| | | |
|---|---|---|
| Surplus balance, March 1, 1894 | | $3,822,049 38 |
| Twelve months' net earnings from business | $734,698 85 | |
| From other sources | 67,710 37 | |
| | $802,409 22 | |
| Less expense applicable to moving factories | 90,499 54 | 711,909 68 |
| | | $4,533,959 06 |
| Less amounts written off in adjustment of matters pending prior to current year. | $78,031 86 | |
| Adjustment and depreciation in current year | 133 408 00 | 211,439 86 |
| | | $4,322,519 20 |
| Interest on bonds and mortgages | $57,386 61 | |
| Interest on scrip | 11,673 60 | |
| Dividends paid | 274,058 78 | 343,118 99 |
| Surplus balance March 31, 1895 | | $3,979,400 21 |

## Standard Telephone and Postal Telegraph Negotiations.

Negotiations have been in progress for some time between the Standard Telephone company and the Postal Telegraph company looking to the purchase of the entire capital stock of the latter concern or a controlling interest in it by the Standard company. It was reported last week that the Standard company had opened negotiations to gain a controlling interest in the Postal. Some time ago the Standard company made an offer of par for the entire capital stock of the Postal company, but the offer was refused. It is now understood that an offer of $15,000,000 has been made for a controlling interest in the telegraph and cable company, and that the offer is receiving consideration. The Standard company has considerable money behind it, and its desire to purchase the Postal arises from its wish to get immediate control over an established long-distance line.

## Telephone Construction Notes.

At its adjourned meeting on June 17th, the city council of Trinidad, Colo., granted a franchise to the Citizens' Telephone company. This company is organized by residents of the town, and its object is to obtain cheaper rates. The promoters are ready to construct the line and are getting estimates, but they have not fully decided as yet whether they will construct the line themselves or award the contract for the entire construction to an outside company. The company solicits correspondence for the construction of the entire plant and equipment.

The Western Telephone Construction company of Chicago has closed a contract with the Department of Justice of the United States for a special telephone exchange at Washington. Commenting upon this, President Keelyn of the Western company says that "It does not look as though the patents will trouble this company when the very fountain head of law selects its apparatus in place of that of the Bell company." The Western Telephone Construction company also closed a contract for the system to be installed in the National Hospital of the Insane to displace the Bell company's instruments now in use.

## Mr. Van Choate's Claims.

According to the *Daily Financial News* of Pittsburg, a new concern, the Van Choate Electric company of Foxborough, Mass., is making a bid for prominence. The following is quoted as an extract from its prospectus: "Mr. Van Choate is the original inventor and patentee of dynamos and motors, and every one now in use as well as every electric car running in this country to day is infringing on his rights. This announcement will be a surprise to most people, but this claim will be substantiated and enforced in the United States courts. There is not an arc lamp, incandescent lamp, modern dynamo, electric motor or tramcar in Mr. Van Choate made many years before any electric light, dynamo or tramcar was introduced in this country, and all the alternating and multipolar machines and motors made and furnished by the General Electric and Westinghouse companies, or any other concern or person in this country, are infringements on inventions made by Mr. Van Choate, and on patents granted to him many years before either of those companies commenced the electrical business, or before any person connected with them had made such machines or motors, and many years before the introduction of the Goulard and Gibbs system. Consequently, this company does not fear anything claimed to have been invented or patented by any other party within that time, which relate to any of the subjects above named. It is fully ten years in advance of any other system in improvements and superiority."

## Fenders for Brooklyn Trolleys.

[From the *New York Herald.*]

Brooklynites should not give up their contention for a law compelling the trolley lines to equip their cars with fenders which will really save life.

The so-called fenders now in use have repeatedly demonstrated their unfitness and worthlessness. In some fatal accidents it appears highly probable that the ill-contrived fender has contributed not a little to cause the death of the victim. Perhaps it would be better to have no fender than the one now in use.

In Baltimore and other cities really effective life-saving fenders, selected by competent engineers, have been supplied to the trolleys and have been found good in practice. Why cannot Brooklyn have the same or some other fender which will protect citizens from mutilation by the trolley?

Mayor Schieren is right in urging the adoption of some method of compelling the Brooklyn trolley companies to equip their cars with real fenders. He should not cease his efforts until this reform is carried.

# CORRESPONDENCE.

## New York Notes.

NEW YORK, July 6.—During the week there has been a vigorous controversy in Brooklyn between Mayor Schieren, the street railway companies and the local press, in relation to the use of fenders upon the trolley cars. Somebody is certainly to blame for the large number of accidents that have occurred, but it looks now as though relief was in sight. President Rossiter of the Brooklyn Heights company has given orders that that system be equipped with the Baltimore fender, which is the invention of President G. Blakistone, of the Central Passenger Railway company of Baltimore, Md., which was given the preference, it being deemed that it was the best life-saving device of the kind. A new idea is about to be used in the selection of motormen by this company. These employes will hereafter be asked to submit to a physical examination, and only capable men will be retained. This is an excellent departure, and it is hoped that the other street railway companies of Brooklyn will follow this example, because during the strike a miscellaneous lot of men was employed as motormen upon the trolley cars, and these men have proven themselves in many instances totally unfit for the work, both mentally and physically.

It is reported that the Fifth Avenue Elevated Railroad company of Brooklyn is about to extend its line from Sixty-fifth street east to a point near the Colver depot, at Coney Island, and it is understood that this company is also endeavoring to get the right of way to Manhattan Beach. If this is accomplished and the Kings County elevated railroad is completed from Bedford Station to Brighton Beach, there will undoubtedly be a vigorous contest between the steam, trolley and elevated roads for transportation of passengers, which will undoubtedly result in a war of rates.

The improvements which have been under way for the past vear upon the Brooklyn bridge are proceeding very slowly, and it would seem that the delay is occasioned by the small number of workmen employed, although the work has to be done under difficulties, owing to the large amount of traffic. However, there is that slow movement of work usually seen where contracts are taken from municipalities. It is estimated that the railway capacity of the bridge will be increased about one-third when these changes are complete, but that they cannot be finished before next April.

W. F. O.

## New England News.

BOSTON, July 5.—For six months there has been a deadlock about the prices to be paid for electric lights between the town of Blackstone, Mass., and the Woonsocket Electric Machine & Power company. Some time ago the town referred the matter to the State Board of Gas and Electric Commissioners, which held hearings and made its answer, July 1st, recommending that the price for electric street lights of nominal 2,000 candle power for all night and every night in the year in Blackstone shall not exceed 42 cents per light per night. In the five-year contract which recently expired the price was 50 cents. The commissioners gave as a reason for their decision that the Woonsocket company is large and flourishing and that the compensation it should receive should be just sufficient to pay a fair general cost for manufacture and distribution, including taxes and management, with such added amount, ample to pay fair dividend upon such percentage of the capital as is required for the entire business of the company, as the volume of Blackstone business bears to the entire business of the company. General Manager Lincoln of the Blackstone company is reported as saying that a small company furnishing light for Blackstone only could not give satisfaction at such a price per light and that the price should be determined by the commercial value of the article produced and not by the cost of production. The gas commission can only recommend and cannot enforce its decision, and Mr. Lincoln says the company will never close a contract with Blackstone on those terms.

On July 2d, for the first time in many months, telegraphic communication between Nantucket and the main land was cut off. This was due to the burning out of the government cable on Martha's Vineyard by the Cottage City trolley lines, which are being rapidly and, it is alleged, recklessly pushed to completion. This is the second time the

trolley line has been allowed to interfere and come in contact with the government wires leading to the cable.

Several members of a family living in Manchester, N. H., have suffered severe shocks from a charged faucet in a kitchen sink. An investigation showed that electric light wires ran over the ridgepole of the building. A wire loop formed a connection between the live wire and the supporting bracket. The electricity ran along the zinc covering the saddle boards to the roof adjoining, thence down the zinc alongside of a chimney to a tin-covered roof and then to an iron soil-pipe that ran down through the block, and thus became connected with the water pipe, and when the members of the family went to get water they had taken hold of the charged faucet and leaned up against the iron sink, thus forming a first-class circuit.

The Superior Court of Connecticut, by Judge Prentice, sitting at New Haven, rendered a decision to-day in the suit of Henry B. Leete against the Southern New England Telephone company, awarding Leete $2,800 damages. Leete sued to recover $5,000 for injury received on the night of November 4, 1894, when he was thrown from his wagon by a wire of a telephone company and his right leg so injured that he was lamed permanently. The wire was blown down during a storm. The telephone company will appeal. C. S. G.

## St. Louis, Mo.

ST. LOUIS, July 6.—The State Supreme Court, on June 25th, handed down a decision which appears to invalidate the franchise of the St. Louis Underground Service company. The validity of this franchise had been questioned for some time, and to test the matter the street commissioner refused to grant a permit to the Underground Service company for the excavation of streets and construction of its conduits. The Underground Service company then instituted mandamus proceedings before the State Supreme Court to compel the street commissioner to grant such permits. The court denies the writ of mandamus on the ground that the city has no power to grant a fixed right to a private corporation or a private person to occupy and use the streets to the injury of public welfare. It appears that by reason of an amendment to its franchise the Underground Service company was in a position to occupy the streets to the injury of the public welfare, although the officers of the company claim that the company is a common carrier of underground electric wires. The company owes its beginning to the National Subway company of Missouri, which obtained an ordinance in February, 1889, authorizing the construction, maintenance and operation of a system of underground conduits. The franchise was granted for a period of 35 years and provided that the city wires should be carried free of cost and that the city might acquire the plant by purchase at an appraised valuation at the termination of the franchise. By an amendment passed in February, 1891, these provisions were both repealed, and the time of the franchise extended to 50 years. A clause providing for the fixing of rates by arbitration was also eliminated from the franchise by this amendment, thus leaving the company free to fix its own rates and thereby destroying all rights to be called a common carrier. Of this amendment the court says: "After the amendment of section 5 of the original ordinance no obligation was left on said corporation to serve the public in any capacity." The inference is that the amendments destroyed whatever chance the company would have had otherwise to claim to be a public convenience. The franchise was sold to the St. Louis Subway company in 1889, and $1\frac{1}{16}$ miles of subway was constructed. In June, 1890, the property was sold at sheriff's sale to the St. Louis Underground Service company. No wires were put into the conduits until May, 1894, when the Postal Telegraph company made arrangements for the rental of ducts for its wires.

In direct line with the recent decision of the State Supreme Court against the Laclede Gaslight company and in favor of the city, now comes another decision by the same court against the Kansas City Gaslight & Coke company, which was claiming a perpetual charter under old legislative acts. The state attorney-general made application for a writ of ouster, claiming that its charter had expired at the end of the twentieth year of its existence, the 20th of last February, and that the company had since that time been usurping privileges and franchises of a corporation that had no legal existence. The writ of ouster was granted.

The Laclede Gaslight company made an application to the State Supreme Court for a modification of the recent adverse decision, whereby it might be permitted to plead further in the case, the object being to re-open the case. The city made application for permission to become a party to the suit, the object being to bring to issue the whole question of the validity of the Laclede charter—a question which was argued fully before the court last March, but was wholly ignored in the court's decision for the reason that the city was not a party to the suit. The court refused to re-open the case and ordered that final judgment be entered against the gas company. The case will probably be appealed to the United States Supreme Court.

These decisions strengthen the position of the city in respect of the control of underground electric wires. A bill has been introduced in the council which will relieve the Board of Public Improvements of the entire underground question and transfer it to the Municipal Assembly. The bill provides that no underground conduits shall be built except by special authority of an ordinance.

The municipal subway scheme is also being looked into again. R. J. H.

## Northwestern Notations.

MINNEAPOLIS, July 5.—The Laird Electric Power & Transportation company of Des Moines, Ia., has been incorporated with $110,000 capital.

C. M. Conradson has drawn plans for six electric pumping stations to fill street sprinklers for Madison, Wis. The wells are now overtaxed and the sprinklers take a large amount of water. The plans provide for a five by eight feet brick station at the edge of the lake and a pump connected with a suction pipe running into the lake, a two horse power electric motor to force the water into small standpipes, from which the sprinklers would load. The standpipe would have a box similar to a fire alarm box, which the driver would open, throwing a switch which would start the electric motor to pumping, and when the tank was full the switch would be cut off. The current would be measured by a meter and the expense would be trifling. It is also suggested to put in large motors, similarly connected, for fire extinguishing, placing the standpipes in the principal business section of the city.

The Hall Electric Power & Transportation company has been incorporated with $510,000 capital at Des Moines, Iowa.

Manager Esterly of the Bathgate, N. D., electric light plant is endeavoring to put in a plant at Drayton.

The Fort Madison, Ia., Street Railway company contemplates substituting electricity for horse power on its lines.

Logan, Ia., has given a 20 year franchise to the E. B. Hillman company of Peoria, Ill., for an electric light system.

C. N. Parker has offered the city of Brainerd, Minn., $60,000 for the electric light plant. He proposes to consolidate the water power and other interests.

While experimenting for new ideas for an electrical display for the Fourth, Electrician Clifton of Jefferson, Ia., narrowly escaped death. The entire city line was cut off and the 1,500 light dynamo short-circuited, producing a spark at the station that prostrated Clifton, and which was taken for a flash of lightning by those who saw it.

The Owsley Block company has been incorporated at Butte, Mont., to generate, manufacture, store, supply and distribute electricity, gas and steam for light, heat and power. The capital stock, is $400,000. M.

## PERSONAL.

Prof. B. F. Thomas of the Ohio State University is in Chicago.

At the recent commencement Yale University conferred the degree of LL. D. on Prof. Henry A. Rowland of Johns Hopkins University.

## ELECTRIC RAILWAYS.

A dispatch from Stamford, Conn., June 28th says: Lightning last night tied up the trolley road here. One flash burned out a volt moter and another soon after burned the armature in the dynamo, which cut off the electric power. The men who run the station noticed the smell of smoke, and when they looked at the dynamo it resembled a Fourth of July pinwheel of dazzling light as the current spread from one coil to another. It will require several days' work to make repairs so that the cars can be run again.

## TELEGRAPH.

The following interesting bit of telegraph history is found in last week's press dispatches: The United Lines Telegraph company was organized on the wreck of the old Bankers & Merchants' Telegraph company, which left to its successors an inheritance of litigation and competition so keen that profits were reduced to a minimum. The judgment filed to-day represents the difference between the sum realized by the sale of the United lines in last November—$300,000—and the amount due on the two mortgages, one of $1,200,000 and another for $900,000. The sale practically represented the desire of the Postal Telegraph company to get control of the main lines of the United lines running from New York to Washington. The first mortgage of $1,200,000 covered that line and therefore when the November sale took place only $300,000 was realized. John W. Mackay and his colleagues, in order to realize their wish, secured the second mortgage, and made the Farmers' Loan & Trust company its trustee. Edward C. Platt, representing Mr. Mackay, took charge of the United lines, and up to the present time has been operating them under lease. Now, however, the Postal Telegraph company's lines are complete and the United will be absorbed by the former company.

## MISCELLANEOUS.

Before long, it is predicted, the present system of voting in the House of Representatives will be abolished and electricity will take its place. The first step toward such a plan already has been taken in the abolition of the old method of calling pages in the house. Hitherto the member who wanted a page had to clap his hands until a boy came. This kept some ten or fifteen boys always waiting on the edge of the speaker's dais. This had proved to be a nuisance long enough, and it has been done away with. Each congressman's desk is now provided with an electric button which communicates with an ordinary hotel annunciator in the lobby. As it was impracticable to attach the wires to the desk permanently, an improvement has been made which permits of the removal of every desk in the place without trouble. Brass plates have been let into the floor, and upon these the legs of the desk stand, being provided with metal contacts. Connection is made through the plates. The new plan will keep the boys out of the house and insure better service than under the old plan. It will also act as the entering wedge for the idea of voting by electricity. It would be easy enough to put buttons upon the desk of each member which would electrically record his vote. Those who favor the plan say that the recording board could be in full view, and that fraudulent voting would be impossible.

## TRADE NEWS.

A. L. Fenton, formerly sales agent for the Perkins Electric Switch Manufacturing company of Hartford, Conn., has accepted a position as agent for the Bernstein Electric company of Boston, Mass., with headquarters at 39 Cortlandt street, New York.

The Electric Protection company of Philadelphia, Pa., reports that it has been obliged to run its factory overtime of late in order to fill the large number of orders for its specialties. A large proportion of these orders was for the Stevens flush switches, which are being shipped to several points in the West. The company has added to its working force and is now considering the advisability of occupying another floor, in order to handle the trade.

The National Water Tube Boiler company of New Brunswick, N. J., makes this announcement: "We take pleasure in introducing to our patrons and the trade Frederick E. Bruce, late manager of the Stirling company of Cleveland, O., with whom we have arranged to take charge of and manage our New York office. We feel assured that he will give all our customers his best attention, and will no doubt call upon you, or will be pleased to have you call at his office, No. 74 Cortlandt street, New York city, where he will extend to you all the courtesy possible, and give you all the information at his command on boiler matters."

The Eddy Electric Manufacturing company of Windsor, Conn., has made some important changes in its working force. H. B. Coho & Co. will have charge of this company's business for New York city and vicinity. G. M. Anger & Co., with office at 64 Federal street, Boston, have the selling agency for the New England states. S. N. Blake has been appointed agent for New York state outside of New York city, with office at Elmira, N. Y. The Eddy company has added much to its position in the electrical field by the appointment of the above named firms, which have been prominently identified with the business for a long time. General Sales Agent M. E. Baird reports that the company has taken some large orders recently, and that the factory is beginning to be rushed to complete apparatus now being constructed. He adds that the prospect for business is much better than it has been at any time during the last year.

## BUSINESS.

The Western Electric company of Chicago is making a special effort at present to exploit its sound-proof telephone booths.

The general revival of business is felt in the electrical supply trade, and the Central Electric company of Chicago reports the outlook as very satisfactory. Lundell fan motors, particularly, are in demand.

The Helios Electric company announces that it is about to remove its office and factory to Nos. 1225–1229 Callowhill street, Philadelphia, from the present location on Filbert street. All communications should be sent to the new address after July 20th.

The Hornsby-Akroyd patent safety oil engine, an English machine, attracted much attention at the World's Fair. The De La Vergne Refrigerating Machine company of New York has now arranged to put this engine on the market in the United States under an exclusive license. The oil engine department of this company will be under the management of George Richmond.

The Electric Appliance company has just made some improvements in the manufacture of its black and white Acme tape, which has always maintained a fine reputation, and now claims that it is just a little better than anything that has been heretofore offered. It has been severely tested in the driest parts of the country, over considerable periods of time, without showing any indication of hardening or drying out. It is unquestionably a good thing.

The Falls Rivet & Machine company of Cuyahoga Falls, O., has secured the contract for the power transmitting machinery which will be required by the Diamond Match company in equipping the large match factory now building at Liverpool, England. The order consists of shafting, ring oiling bearings, friction clutches, steel rim pulleys, gears, etc., and the company is naturally much elated over its good fortune in securing such an order, as the equipping of a large factory in that locality with its machinery

will be of considerable benefit to it. The company has already fitted up several factories in this country for the Diamond Match company, and the recent order demonstrates the fact that the material heretofore furnished has given perfect satisfaction.

The Fiberite company, manufacturer of the Medbery overhead material, reports a very satisfactory increase of trade during the last month. The Mason Electric Equipment company, 307 Dearborn street, Chicago, selling agent for the company, has closed a number of contracts lately and has received a large number of testimonials from roads using this material. The switches and sockets lately put on the market by this company are also considered to be of superior quality and workmanship.

It will greatly interest consumers of incandescent lamps to learn that the American Electrical Manufacturing company of St. Louis has engaged as its superintendent A. L. Reinmann, a gentleman well and favorably known among the electrical workers of the country. Mr. Reinmann has been engaged in the manufacture of incandescent lamps almost from the beginning of the business, and was superintendent of the Westinghouse Lamp Works in Pittsburg, and then of the Sawyer-Man Electric company of New York, and his ability as a manufacturer of high grade lamps is well known. He has already entered upon his new duties, and the high repute of the American lamps will be maintained and the quality enhanced by the introduction of some marked improvements recently made by Mr. Reinmann. The company reports business as being very good for the season, and is preparing for a rush of orders when the fall business opens.

The Belknap Motor company of Portland, Me., is making an active bid for business. A recent catalogue has this introductory paragraph: "This catalogue illustrates and describes briefly our B. C. standard dynamos, power generators and motors. We invite the attention of the public to the following features: The neatness of the design, the simplicity, the compactness, the distribution of metal for solidity and strength, the large bearings and short and symmetrical magnetic circuit. The material used in the construction and the labor employed are first-class in every respect. The efficiency, economy and regulation are the best attainable. Every machine is thoroughly tested before shipment and a record kept on file showing performance of machine under load, and the insulating powers are tested at double the voltage to be used in practice, which is the accepted rule from the highest authority. We solicit correspondence in regard to anything in our line, and all inquiries will receive prompt attention."

Mr. Jordan, of the firm of Schiff, Jordan & Co., of Vienna, Austria, carbon makers, is now in this country. He has placed the selling agency for the "Ship" cored carbons for the United States and Canada with F. S. De Ronde, who, in connection with the firm of A. De Ronde & Co. of 254 Front street, New York, will distribute the goods. These gentlemen, after careful inquiry, both here and in Europe, regarding the quality and standard of this carbon, accepted the agency, feeling confident that there was no better carbon offered for sale, and that all the claims made for it can be demonstrated, a trial showing a steady and brilliant light with small consumption of current. De Ronde & Co. desire at once to establish agencies in all parts of the United States, so that central station managers and private consumers can have their orders filled promptly. They have made arrangements to carry a large stock of carbons, so that even the heaviest orders can be filled without delay. Samples of the "Ship" cored carbons will be furnished gratis on application to A. De Ronde & Co.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued July 2, 1895.*

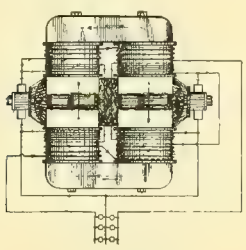
541,854. Dynamo-electric Machine. Thomas H. Hicks, Detroit, Mich. Application filed August 29, 1894.

Two generating armature circuits are mounted upon one shaft, and field magnets are provided with two sets of shunt coils, one being supplied with current from one armature circuit and the other set being supplied with current from the other armature circuit.

541,919. Commutator Brush. Herman B. Collins, Fulton, N. Y. Application filed January 26, 1895.

A supporting body and a contact piece hinged to the body, and consisting of separate sections arranged end to end.

541,921. Manufacture of Electrical Conductors. Louis W. Downes, Providence, R. I. Application filed April 2, 1895.

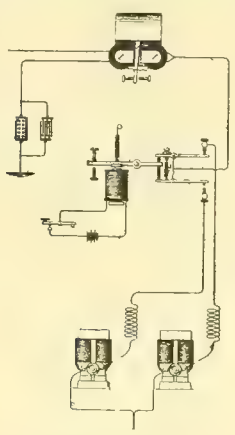


NO. 541,854.

An insulated electrical conductor, comprising a wire, a fine fibrous covering coated with a film of rubber, a compact winding of asbestos fiber saturated with soluble glass, and an exterior braided asbestos covering coated with fire-proof cement, are the features claimed.

541,929. Incandescent Electric Lamp. Robert Greer, Westbrook, Me. Application filed November 10, 1894.

The method of making incandescent lamps consists in placing wholly within a receiver upon suitable supports a glass bulb open at its lower end, and then inserting into the receiver a plug consisting of a filament and its support, the base of which is encircled with elastic material, then closing the receiver and exhausting the air therefrom, and then forcing the plug into the glass bulb.



NO. 541,994.

541,967. Automatic Telegraphy. Patrick B. Delany, South Orange, N. J. Application filed April 3, 1895.

One claim is for a received ribbon-record, having characters representing dots in one line, and characters representing dashes in duplicate on opposite sides of the line of dots

541,969. Trolley Wire Clip. Fred W. Haeusgen, Buffalo, N. Y. Application filed October 9, 1894.

The claim describes a trolley clip or support consisting of an elastic sheet metal support, its upper separate ends having apertured projections, which register when the wire is in position, and which can be pulled apart to admit the wire within the support, a removable wedge-shaped clamp provided with a groove in its lower side and a socket in its upper portion, the shank consisting of an upper portion adapted for screw-threaded engagement with an insulating bell or hanger, the lower screw-threaded portion with the downwardly extending projection for engagement with the socket in the clamp, the annular shoulder between the two screw-threaded portions and the elongated nut.

541,994. Duplex and Diplex Telegraphy. Minor M. Davis, Brooklyn, N. Y. Application filed April 18, 1895.

The arrangement shown in the cut comprises a transmitting device, consisting of two fixed contact points, two movable contact points formed of two similar, unequally pivoted, spring retracted levers, an actuating lever mechanically connecting with the shorter arms of the two first named levers, electrical connections between the main line and one pair of contact points, between one of the second pair of contacts and a positive dynamo pole or source, and between the other contact of the pair and a negative dynamo pole or source.

541,998. Electric Wire Joint. Alfred Gartner, Newark, N. J. Application filed May 24, 1895.

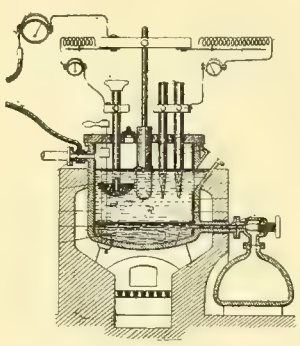
A wire joint consisting of a tube is provided with a longitudinally and spirally arranged slot. The tube is adapted to be twisted with and around the inclosed wires.

542,002. Trolley Restoring Attachment. William D. McDaniel, Philadelphia, Pa. Application filed October 29, 1894.

The restoring pulleys are mounted on the bearings, independent of the bearings of a trolley wheel, and having a space at the inner ends.

542,036. Electric Locomotive. Thomas E. Adams, Cleveland, O. Application filed October 3, 1894.

The combination with car axles, of motor casings, flexible connections between the motor casings and axles, a bar having a sliding connection with the casings, and flexible connections between the casings and bar at points between the ends of the latter, is claimed.



NO. 542,057.

542,049. Galvanic Battery. Ralph W. Gordon, Boston, Mass. Application filed January 31, 1895.

A jar containing an exciting fluid, a negative element consisting of a receptacle containing a depolarizing agent, and having empty chambers therein, the walls of the receptacle and chambers being perforated for the better permeation of the exciting fluid, and a positive element in the exciting fluid.

542,052. Telephone System. Angus S. Hibbard, Chicago, Ill. Application filed February 21, 1895.

Telephone lines extending in groups to divided boards of an exchange, and two or more intermediate boards, trunk lines extending between the divided boards and the several intermediate boards, adapted to be connected with the telephone lines to extend the circuits at will to any one of the intermediate boards, and means at the intermediate boards for uniting two trunk lines, whereby the connection between any two lines may be completed through any intermediate board at will.

542,057. Electrolytic Process and Apparatus. Leon P. Hulin, Modane, France. Application filed December 19, 1894.

The process of manufacturing an alloy of an alkali metal or alkali earth metal with a heavy metal consists in effecting the electrolysis of a suitable haloid salt of an alkali or alkali earth metal when in a state of igneous fusion by means of two anodes, one of carbon and the other formed of the heavy metal to be alloyed.

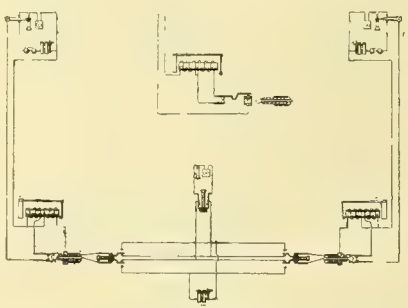
542,066. Annunciator Circuit for Telephone Switchboards. Charles E. Scribner, Chicago, Ill. Application filed November 12, 1894.

The first claim reads: The combination with a telephone line of an electro-magnet provided with two equal differentially wound helices one of said helices being inclosed normally in the line circuit, and mechanism operated by the act of making connection with the line at the central station for including said second helix in circuit with the line, whereby said annunciator is rendered neutral.

542,105. Conduit Electric Railway. Leonidas C. Pressley, San Francisco, Cal. Application filed February 13, 1895.

Insulated trolley rails are fixed within a conduit in alternate lines, a double trolley is adapted to form contact alternately with one rail and the other, an electro-magnet is connected with the terminal end of each rail, and a swinging armature upon which the magnet acts is adapted to form contact with the main conductor and energize the electro-magnet as the trolley wheels pass from one rail to the other, and temporarily charge the succeeding rail by the current from the preceding one.

542,108. Train Annunciator. Charles H. Rittenhouse, Kendallville, Ind. Application filed February 14, 1895.

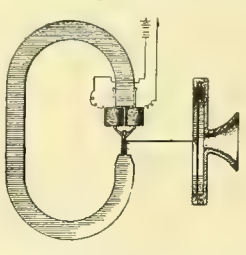


NO. 542,066.

In a train annunciator operated by electricity there is the combination with the intermittently operated magnets and their appropriate armature of the lever, having a pivoted detent provided with a pivoted spring-actuated pawl or finger, a rotary indicator drum, having a shaft provided with a duplex ratchet wheel, a pivoted back-lash pawl, and a rod connecting the pawl to the armature lever.

542,109. Coin Operated Toll Collector and Annunciator. William A. Rogers, Omaha, Neb. Application filed March 7, 1895.

A coin operated toll collector and annunciator is described, comprising a suitable signal, a chute consisting of a series of sections, the first section being stationary, and each succeeding section pivotally supported and inclined alternately at different angles, so as to form a zig-zag way for the passage of a coin, electrical contacts arranged in the path of movement of the pivoted sections, whereby the latter are adapted to close the electric circuit when tilted by the weight of the coin, each alternate pivoted section being located below and at one side of the



NO. 542,191.

preceding section, and adapted to cause a distinctive response from the signal during the passage of the coin or token from one section to the next succeeding section, whereby the operator may readily ascertain the value of the deposited coin

542,164. Conduit Electric Railway. Louis R. Lavalle and Albert H. Lavalle, Holyoke, Mass. Application filed March 17, 1894.

In an electric railway there is the combination with the trolley and switch wires, of the insulating supporting blocks arranged beneath the wire ends, means for fastening the wires to the blocks, and insulating cushions arranged between the wires and the blocks.

542,191. Magneto-electric Telephony. Edward S. Halsey, South Evanston, Ill. Application filed April 20, 1894.

In magneto-electric telephony the method of transmission consists in compelling a magnetic current practically constant in quantity and direction, to be diverted variably through dual paths included by the magnetic circuit in responsive keeping with the air vibrations due to vocal sounds, and thereupon exciting inductively in the electric circuit at the local path or paths derived impulses responsive to the shifts in the magnetic flow at such path or paths.

542,210. Safety Device for Handling Electric Arc Lamps. Edward P. Snowden, St. Joseph, Mo. Application filed March 22, 1895.

There is a combination of block conductors, spring conductors, switch, switch conductor and notch or spring switch receiver and bracket.

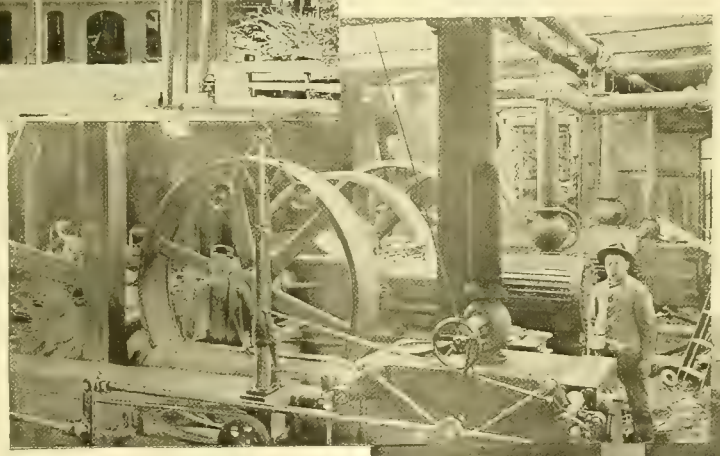
# Western Electrician.

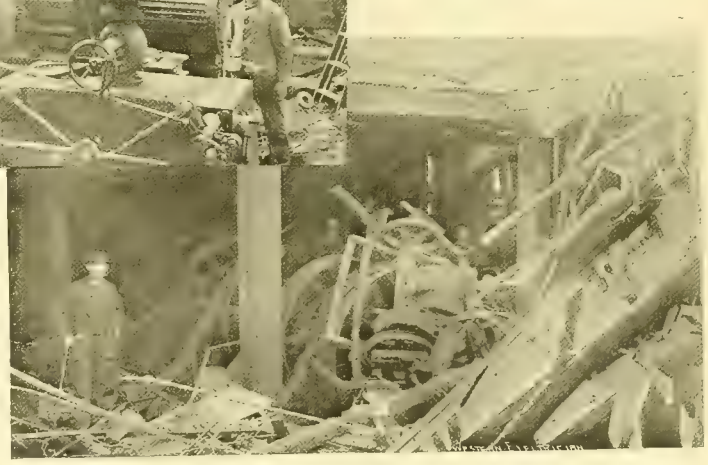
EVERY SATURDAY.

Vol. XVII. CHICAGO, JULY 20, 1895. No. 3


## Seattle, Wash., Consolidated Street Railway Company's Plant Destroyed by Fire.

On the morning of June 20th fire was discovered in the power house and car barns of the Seattle, Wash., Consolidated Street Railway company. The views presented on this page give a fair idea of the extent of the damage to the structures. The loss is estimated at from $75,000 to $100,000, with insurance, distributed between the Union Assurance, Western Insurance, Milwaukee Mechanics, Royal Exchange, Trans-Atlantic, Phœnix of Hartford, London Assurance, Westchester, Alliance and National companies, amounting to $40,000. The cars, supplies, etc., were practically a total loss; the dynamos were injured to the extent of about 20 per cent., and the engines and boilers 15 per cent. The electric equipment consisted of two 60 kilowatt Edison bipolar railway generators, one 60 kilowatt National multipolar railway generator, seven D 62 Thomson-Houston bipolar railway generators, two Western Electric 50 light arc machines, two National 1,000 light alternators, with switchboards, etc. Of these, seven railway generators are now in service.





SEATTLE, WASH., CONSOLIDATED STREET RAILWAY COMPANY'S PLANT DESTROYED BY FIRE.—VIEWS OF THE RUINS.

The building destroyed was a substantial brick structure, 60 by 260 feet, occupying the entire side of the block on the north side of Pine street between Fifth and Sixth streets, and was so constructed on a hillside that the main floor, constituting the car house and repair shop, was on a level with Fifth street, while the basement floor, on which was located the boiler and engine and dynamo rooms, was on a level with Sixth street.

The company is unable to account for the origin of the fire, nor has it as yet been determined just where it started. It had gained so much headway before the fire department was summoned that little could be done toward fighting the flames. It will be some time before the ruins can be cleared away and the work of reconstruction begun. In the meantime the service will be continued, as every available car has been pressed into use and arrangements have been made for getting current to operate the lines. Scarcely any interruption was experienced in the operation of the system, much to the surprise of the patrons of the system, as the extent of the damage suffered by the company led the people to believe that it would be impossible to run cars for several weeks.

The history of the company may be briefly outlined. As its name indicates, it is a consolidation of several lines—the Front Street Cable Railway company, the Green Lake Electric Railway company, the North Seattle Cable company and the Rainier Railway & Power company are included. The capital stock is $1,500,000, and the last financial statement issued by the company shows that the cost of the road and equipment was $2,128,868. The company has experienced financial reverses since its formation in 1891, the receipts decreasing from $125,654 in 1892 to $98,121 in 1893 and $76,938 in 1894. The property is considered valuable, however, and as the company holds a 50 year charter from January 14, 1891, and has many valuable franchises, it is believed that careful management and returning prosperity to general business will make it a really desirable investment eventually. It is probable, therefore, that the damage done by the recent fire will be repaired at once and that the company will continue to operate its lines until its plant is reconstructed, by making a temporary arrangement for securing current.

## Street Railway Celebration at Kalamazoo.

On June 22d the second anniversary of the establishment of the electric railway system of the Citizens' Street Railway company at Kalamazoo, Mich., was celebrated by the citizens of the town as a public holiday. The company announced that it would provide an entertainment at Lake View Park and give away 1,000 tickets in honor of the day. The people generally fell in with the idea; the city council took favorable action; the mayor issued an appeal to the citizens for a general observance of the day, reciting the benefits to the city of the rapid transit system and stating that the company had given "the most efficient service possible;" laudatory editorials appeared in the newspapers; many manufacturers closed their establishments, and the whole celebration proved entirely successful. The holiday will probably be celebrated every year. The success of the idea was very complimentary to the railway company and demonstrated the existence of unusually cordial relations between it and the citizens of the town. Theodore P. Bailey and James W. Johnson of Chicago are president and treasurer, respectively, of the company.

## Gas Engine Central Station in Chicago.

The central station of the American Gas Engine Electric company at Clark and Lake streets, Chicago, is nearing completion. This station contains engines of 400 indicated horse power, directly belted to dynamos. The largest unit will be a 200 horse power tandem engine, similar to those in the station at Belfast, Ireland, illustrated a few weeks ago in the WESTERN ELECTRICIAN.

The Highland electric railroad of New Albany, Ind., will be sold on July 24th to satisfy a mortgage of $50,000.

## Evansville, Ind., Lighting Contract.

The action of the city officials of Evansville, Ind., on the street lighting contract during the coming weeks will be watched with interest by the public generally and the electrical community in particular.

The present contract of the Evansville Gas & Electric Light company with the city for lighting the streets expires August 15th. In response to advertisements for bids for lighting the city for a period of five years, two proposals were received by the Board of Public Works, both from local companies. The Evansville Electric Light & Power company (operating Fort Wayne apparatus) agreed to furnish 400 arc lamps of 2,000 candle power at $119.43 each per year, while the Evansville Gas & Electric Light company (operating Brush system) proposed to furnish 200 arc lamps of 2,000 candle power each at $95 each and 200 Welsbach gas burners at $20 per year.

At the opening of bids the Evansville Electric Light & Power company claimed to be the only bidder complying with the specifications, which called for 400 arc lamps and said nothing about gas lamps. The Evansville Gas & Electric Light company claimed that, owing to the dense foliage on many of the streets, the gas lamps, which are on a much lower level than the arc lamps, would give greater satisfaction than the latter.

The matter was referred to the city attorney, who reported favorable to the bid of the Evansville Gas & Electric Light company, stating that it was the best bid, and he was then instructed by the Board of Public Works to draw up the necessary contract for signatures.

The Evansville Electric Light & Power company has filed suit in the Superior Court to restrain the Board of Public Works from awarding the contract to the Evansville Gas & Electric Light company, on the ground that its bid does not comply with the specifications.

At present there are 10 towers 150 feet high in use, each supporting four 4,000 candle power lamps. The new contract provides that these lofty structures shall give way to mast arms supporting one 2,000 candle power lamp each, which, it is thought, will give much better distribution of light.

## In the Matter of Appearance.

There are few sights more fitted to convey an idea of power than a steam locomotive just starting or arriving, says a writer in *Lippincott's Magazine;* the whistling and roaring of the steam, the throbbing in the smoke pipe, the tremor of the ground, lead the mind to expect a proportional effect, as from some animate monster. An electric locomotive in a similar situation is an embodiment of apathy and harmlessness in its appearance. There is neither throb nor roar, no steam to scald the wayside passer, nor cindery, sooty smoke to blind the eyes, choke the breath or stain the immaculate linen. In action, however, the electric machine, still comparatively quiet in its movement, often rolls along with a tigerish purr or a hum as of a vast swarm of angry bees, with now and then a lurid flash—weird

evidence of the mysterious power, invisible as the wind, that lurks in the miles of wire curled round and round the magnets and armatures of the huge electric motors concealed in the dark interior of the massive frame.

## New Method for the Better Regulation of Power Generators Driven by Water.

The serious difficulties experienced in the operation of the water-driven plant of the Ottawa, Ont., electric railway, previously described at length in the WESTERN ELECTRICIAN, were for the most part overcome, excepting with reference to the absolute steadiness of voltage, which it was desired should ultimately equal that of a steam driven plant. The speeding up incident to a sudden withdrawal of work on the line was always necessarily followed by increased speed of dynamos and electromotive force, and, conversely, frequent sudden demands for more power resulted in a check upon the armatures more or less violent. This also reduced the strength of fields and largely contributed to the slowing-up effect by neutralizing the momentum of the driving machinery, which might otherwise carry the armature over these frequent light demands if the strength of field remained constant.

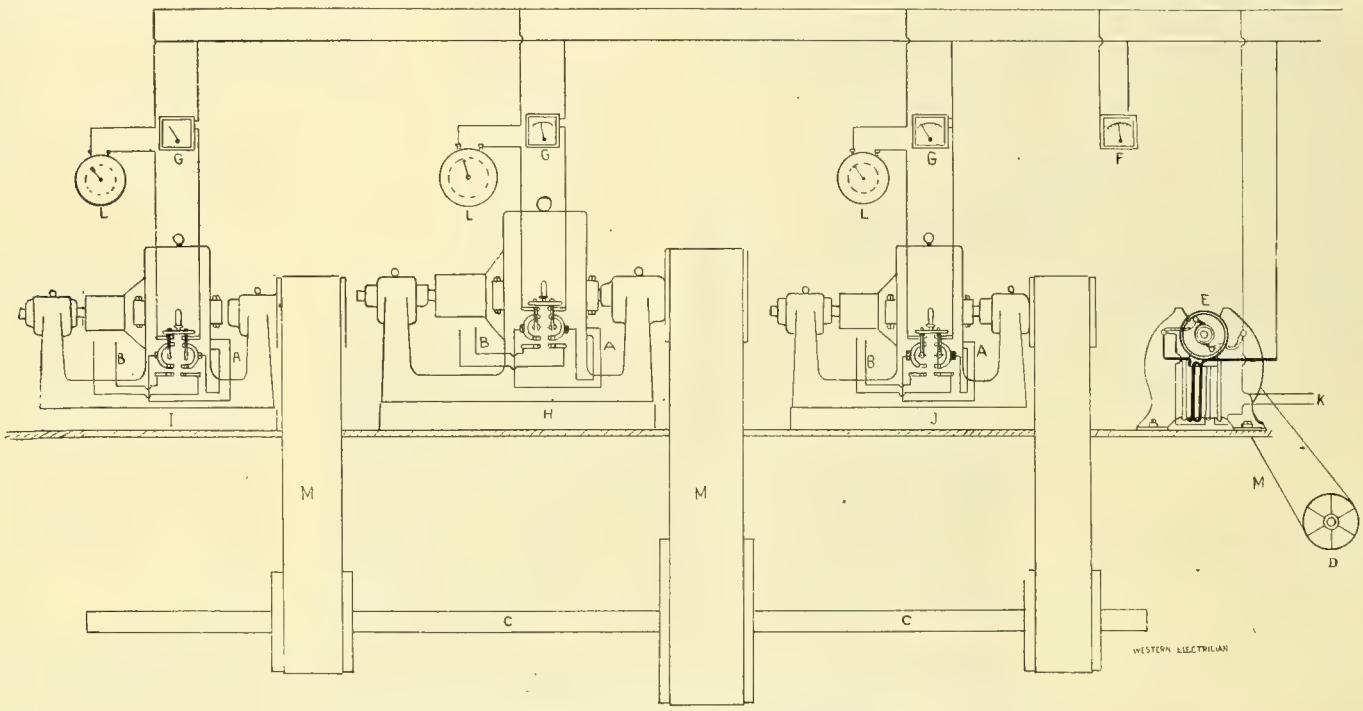
During the last winter T. Ahearn, managing director of the Ottawa Electric Railway company, and a member of the well-known Canadian electrical firm of Ahearn & Soper, the builders and principal owners of the plant at Ottawa, decided that an independently driven water wheel to operate an independent 500 volt dynamo, the current from which would be employed exclusively for the purpose of exciting the fields of his company's three street railway generators, would remove a multitude of variations of electromotive force incident to self-excited water-driven dynamos. The necessary work to accomplish this result was completed in the latter part of January last, since which time the plant has been operated with great success upon this plan, and has greatly exceeded expectations.

By reference to the diagram it will be seen that an ammeter is included in each dynamo field circuit, and placed upon each dynamo is a small double-throw switch, so that in the event of an accident to the exciting dynamo or its driving wheel, the several dynamos could be self-excited by throwing the switch on each dynamo, which would connect the armature of each with its own field. In the diagram *A* shows the circuit to generator fields and *B* to ammeter; *C* is the main driving shaft; *D* the independent shaft for the exciter, *E*; *F* is a voltmeter and *G* an ammeter; *H* is a 700 horse power Westinghouse generator and *I* and *J* are 400 horse power machines of the same make; *K* is the circuit to the exciter rheostat, and *L* to the generator rheostat; *M* is a driving belt. The total exciting current required for the three generators is less than 20 amperes.

Among the many advantages of this system are the following: Steadiness of voltage, removal of the danger of burning out fields by abnormal armature speed, relief to the driving machinery, removal of fields from the line circuit, preventing any possible damage to them by lightning or other cause, the prevention of damage to commutators formerly caused by short-circuits upon the line throwing open the circuit breakers and short-circuiting the current across the commutator. These troubles are now entirely absent. Considerable time is also saved in throwing in dynamos, which is now done without delay after circuit breakers are reset. This formerly required a very considerable time in synchronizing fields.

The splendid success which has attended the operation of this water plant in Canada should commend it to the serious consideration of the owners of water power plants in America, which are already numerous and will always be increasing in number. And there is no doubt that many of those interested, who may attend the coming convention of the Street Railway association at Montreal in October next, will visit Ottawa to personally inspect this valuable means of removing defects and annoyances incident to the operation of electric railways by water power. Ottawa is but 3½ hours by rail from Montreal, and, in addition to its being the capital of the Dominion, is a city of 50,000 live people, who boast of having an incandescent lighting installation of one lamp for each head of population, and an electric railway of 30 miles of track, operating 40 cars daily, which, in the matter of service and equipment, is unsurpassed.

Ottawa is recognized as of the first importance electrically, and also enjoys the proud distinction of having first solved the snow problem, demonstrating that an uninterrupted electric street railway service could be successfully maintained throughout a Canadian winter.




NEW METHOD FOR THE BETTER REGULATION OF POWER GENERATORS DRIVEN BY WATER.

## Philadelphia Trolley Parties.

Quakerdom has been seized with an epidemic which promises to carry away the borders of its traditional sobriety, writes a Philadelphia correspondent. With the advent of the trolley cars there came what was at first a mild form of fever, but it has now reached the violent stage, and the quiet of the night is rudely disturbed by the shrill echoes of tin horns, brass bands and shouts of merriment. On almost every line of trolley railway the trolley party has sprung into existence, and with gayly lighted cars, trimmed with flags, all Quakerdom seems to have yielded to the mad whirl of dissipation. The trolley party has developed a distinct character as a kind of summer night's recreation. When the electric street car service came into existence the trolley party came with it, and with a flattering promise that it has come to stay. To-day it is no longer in its infancy. It has reached the full vigorous maturity of an adult age, and has powerfully commended itself to public favor as an efficient aid to life, health and digestion. It is something that both youth and age cling to with a joyous animation,—youth with an exuberance of flowing spirits and age with a mild and decorous manifestation of pleasure. Thus young and old are the patrons and beneficiaries alike of the trolley party, and having such a hold on the hearts of the people the street railway corporations have recognized in it an emergency that must be met, and up to the present time they have succeeded in meeting it. Ice cream is served on one special car and stronger refreshments may yet be dispensed.

## Thank You.

The WESTERN ELECTRICIAN with its issue for July 6, 1895, entered upon the ninth year of its existence. We congratulate our Chicago contemporary on the successful attainment of this very respectable age and we express the hope that its present prosperous condition may long continue.—*Electrical Review*, New York.

## Copper—Native, Electrolytic, Impure.

By C. C. HASKINS.

Copper, as deposited by nature, is, compared with other forms, far the most desirable for electrical purposes. It has the three pre-requisites of excellence—purity, malleability, ductility—characteristics seldom found in any other form of the metal, and is withal the best available electrical conductor.

In the re-smelting of copper it is difficult to prevent an admixture of some other metal, especially if there is an opportunity for a lot of junk metal mixing in the mass. Every soldered joint contributes more or less tin to the mixture, and many of the best wires are tinned their entire length. This small amount of tin mingled with the copper materially reduces the excellencies heretofore mentioned. Anyone who has had occasion to handle a soldering copper knows how hard the point becomes when the copper is to be filed down for re-tinning. The extreme hardness of the point is alone due to the alloy of copper and tin. The famed copper chisels of the Peruvians, with which that people cut stone, were made of an alloy of copper and tin, which is much harder than either of the metals entering into its composition.

Electrolytic copper, could it be procured pure, cheap, and readily, would undoubtedly prove as valuable as that which nature has so lavishly strewn over the earth "Toughness 2.5 to 3.0, density 8.85, color reddish, bright metallic luster, very ductile, very malleable, very good conductor of both heat and electricity," and "Native copper is red, sonorous, very ductile, malleable, tough," is what the authorities tell us of the two forms.

Unfortunately electrolytic copper suffers too often from imperfect or careless handling, and is too generally chemically impure for scientific uses and inferior for electrical purposes. But nothing short of an expensive chemical examination will show the kind of impurity which a sample contains. As to its electrical conductivity, that may be found by actual measurement, with proper laboratory appliances.

But in these days of rush and confusion, it is seldom the case that one will stop to inquire or think even of the percentage of foreign metal there may be in an invoice of wire. A considerable percentage of all the old wire recovered from deserted or condemned installations, from burned buildings, damaged cables, etc., gets back to the wiremakers, and some of this undoubtedly is worked over into wire again and again, as is the case with the scrap of other metals.

It has been claimed that pure native copper is far more expensive to convert into merchant metal than the sulphurets, oxides, sulphates, carbonates and other combinations, because of its peculiar toughness, while the ores are readily broken up and handled. In the ores the metal is found in combination with silver, arsenic, antimony, mercury, zinc, iron, chlorine and sulphur.

The methods employed for the conversion of the ores are comprised in ten steps, as enumerated by metallurgists, before the last or pure condition is reached.

Syracuse, N. Y., is to be connected with the villages of Fayetteville and Manlius by an electric railway 12 miles long. Water power will be utilized.

## Some Observations on a Direct-connected 300 K. W. Monocyclic Alternator.[1]

By Dugald C. Jackson and S. B. Fortenbaugh.

Before giving the results of the observations we have taken, it will probably be desirable to give a brief description of the machine. The machine is the new monocyclic alternator, manufactured by the General Electric company, of 300 kilowatts capacity—1,150 volts, 260 amperes—at a speed of 140 revolutions per minute. It is directly connected to a Russell, tandem-compound, high-speed condensing engine, which ran during the test about 15 revolutions more than the required speed. The armature is of the iron-clad type, 110 inches in diameter, 10½ inches wide, with about three-sixteenths of an inch clearance, and is furnished with two sets of windings.

According to Dr. Louis Bell the cross-section of the main and teaser coils is the same, but the latter has fewer turns and is placed in shallower slots midway between the main coils. The pressure developed by the teaser coils was .7 of the pressure across the main terminals of the machine. There are 96 slots on the armature, one-half of these being used for the main coils and the other half for the teaser coils. Three collector rings are used, one being connected to each end of the main coil, and one to the free end of the teaser coil. These are made of brass, two inches wide and three-fourths of an inch thick, and each has two brushes, five-sixteenths of an inch thick, covering its full width. The rectifier for the series excitation is 4¾ inches wide and has 48 segments 1¼ inches in width. Two sets of brushes are used for both the positive and negative poles of the rectifier, each set consisting of two copper brushes 1¾ inches wide by five-sixteenths of an inch thick. Only about .63 of the total current is rectified in this machine. The magnet cores are laminated, 48 in number, and are 10 by 4¼ inches face and 10¼ inches deep, the outside dimensions of the field windings being about 12 by six inches. Each magnet spool carries a series coil, and a separately excited coil, all the series and separately excited coils being separately connected in series.

The series coils are formed of two flexible cables in parallel, having a total cross-section of about 98,000 circular mils, while the cross-section of the separately excited coils is about 33,100 circular mils.

The exciter used was a four-pole continuous current machine, of the new General Electric, slow-speed type, belted directly from the dynamo shaft, and therefore all power measurements include the power furnished to the exciter. The output of the exciter is 52 amperes at 125 volts, and its speed 850 revolutions per minute. Standardized Weston instruments were used, with the exception of the main ammeter in the generator circuit, this being the regular station instrument furnished by the General Electric company. This instrument was quite sensitive, and, while no means were at hand for calibration, we think the results may safely be taken as a fair indication of the performance of the machine. The principal dimensions of the engine are as follows: Stroke, 24 inches; diameter of high pressure cylinder, 15 inches; diameter of low pressure cylinder, 24 inches.

Figs. 1 and 2 represent a set of cards taken from the engine, and following are the electrical readings taken at the same time: 124 amperes, 1,144 volts, 146 revolutions per minute. The exciting current was 51 amperes.

In planning the test we fully expected to make a 10 hour continuous run at full load, and determine the heating, efficiencies, etc., but were unable to go farther than slightly above half load. In the first place the engine was pided to a sing'e boiler of insufficient capacity, and secondly the engine was too small to carry the full load of the generator, and in addition its regulation was defective, the total variation of speed being as much as 15 per cent. Fig. 3, therefore, shows an efficiency curve for slightly above half load, and from this it will be seen that the commercial efficiency of the generating set is about 81 per cent. at half load. When these observations were made the machine was in commercial service with the regular transformer load. The commercial efficiency of the generating set is taken as the ratio of the electrical output to the indicated horse power. The electrical horse power here used is taken as the product of amperes and volts, the power factor of the circuits, therefore, being assumed at 100. Actual measurements have shown that the power factor is at any rate over 98 per cent., and consequently the error made by this assumption is comparatively small. The diagonal lines in the figure show respectively the indicated horse power and the electrical horse power at different loads, the vertical scale for these being at the right hand of the figure. For the ordinary changes of load, the regulation of the alternator is not entirely effected by the series coils as the machine now stands, but requires considerable hand regulation. However, this can probably be improved by altering the shunts across the rectifier and series turns respectively, thus giving a greater number of ampere-turns in the series coils. This lack of regulation on the part of the alternator, combined with the unsatisfactory regulation of the engine, makes the performance of the generating set somewhat below the standard for this class of machinery when under ordinary working conditions, but, as a whole, the unit is a magnificent piece of mechanical construction.

1. Read before the American Institute of Electrical Engineers, Niagara Falls, June 26, 1895.

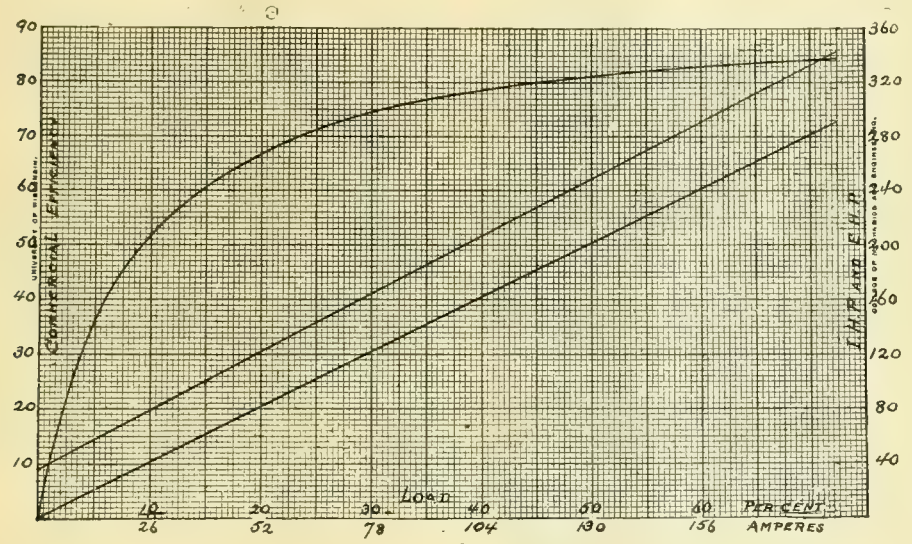



FIG. 3. SOME OBSERVATIONS ON A DIRECT-CONNECTED 300 K. W. MONOCYCLIC ALTERNATOR.

## Milwaukee Street Railway Taxes.

The recent decision of the Supreme Court of Wisconsin in the Milwaukee street railway assessment case is of importance to every city which has an electric railway or an electric lighting system or any quasi-public enterprise of a similar nature. Last year, for the first time in the history of the city, the Board of Review assessed franchises of the Milwaukee Street Railway, the Badger Illuminating company and the Edison Electric Illuminating company, as well as the poles, tracks, and everything else pertaining to the conduits or road-bed of the Milwaukee Street Railway company, which controls the lighting companies as well as the street railway. The assessment was an increase of $1,714,050 over that of the previous year, and the company at once took steps to appeal the case to the courts. In the Circuit Court the company won its suit, whereupon the city appealed to the Supreme Court. The company's victory was announced in the Western Electrician, June 29, 1895.

The text of the Supreme Court's opinion is interesting as well as important. It is declared that the assessment against the Milwaukee Street Railway company for the franchises of the Edison Electric Light company and of the Badger Illuminating company or for any property belonging to these two companies cannot be sustained, for the reason that such franchises and property belong to the companies and are proper matter of assessment against them and not against the Milwaukee Street Railway company, the controlling corporation. These franchises are inalienable, and the companies have no right to transfer them and their other property to the Milwaukee Street Railway company, so as to prevent them from performing the duties that they owe to the public in return for the franchises granted to them by the city.

In regard to the assessment of the street railway proper, it had been contended in behalf of the company that the city had no right to assess its franchises, for the reason that no provision or rule had been enacted for their valuation; that the ties, poles, tracks, etc., are real estate and as such assessable only in the ward in which they are located; that it was not competent for the city to assess the land on which the power houses are located in various wards and assessments districts in the Seventh ward, where the company has its principal office, as an entirety, and that even if such an assessment in entirety were competent, the assessment in question was not legal, for the reason that the assessment was not made in an entirety, the power houses and the premises on which they are located being assessed separately from the franchises and other property.

These questions, the Supreme Court declares, are important, in view of the great and constantly increasing amount of capital invested and used in connection with such franchises by water, light and street railway companies, the franchises and property of which are charged by reason of their legal connection with important uses in favor of the public. It is conceded, the opinion states, that street railway franchises are property; indeed, there is no authority whatever for supposing that they are not property, and it is also established that the franchises of the company and its property are indivisible, not being subject to severance by sale for taxes under the general operation of the tax laws or other

Indicator card from low pressure cylinder, 20 lb. spring, speed 146. Total, I. H. P. Low pressure cylinder 107.8 E. H. P 190.

FIG. 2. SOME OBSERVATIONS ON A DIRECT-CONNECTED 300 K. W. MONOCYCLIC ALTERNATOR.

legal process. The court cites the general statute exempting railroad property from taxation, in view of the license paid directly into the state treasury, and then, in order to show that the legislators of the state never intended that street railway property should not pay taxes, the court quotes the amendment, made when street cars began to make their appearance, expressly excluding any horse railroad in any city or village from the operation of the exempting statute and the subsequent amendment expressly excluding any cable or electric railroad in any village or city from exemption so far as the taxing of its property by such village or city is concerned. The Supreme Court then quotes authorities to show that the franchises of such horse railroad or cable or electric railroad are property and very valuable property. The Supreme Court goes on to say, in reply to the point made by the company that its franchises could not be taxed because there had been no rule established for the taxation of such property, that legislative direction as to the manner of valuation is a convenience rather than an absolute necessity, and the lack of such direction does not argue the absence or the suspension of the general power to tax. The court declares that the value of franchises, especially in connection with the property reasonably necessary for their exercise and use, can be determined, although perhaps not so readily or so certainly as the value of the other subjects of taxation. The cardinal requirement is that as property such franchises shall be assessed, and all else is a matter of method and detail. The assessors or Board of Review would seem to be competent under the statute to assess such franchises and to extend the taxes.

The company sustains the point that the franchises and corporate rights of a quasi-public corporation and the property necessary for its use are indivisible, being an entirety, and cannot be sold in part under adverse process, as such sale would prevent the company from discharging its duties to the public. Regarding the matter in this light, the court continues, the proper place for the assessment of the property as an entirety was its principal office or place of business, and it quotes a decision of its own in support of this position, as well as decisions of a number of other state Supreme Courts.

It will be seen that while the Milwaukee Street Railway company succeeded in knocking out the assessment for 1894 upon its franchises, road-bed, tracks, poles, conduits, etc., the city established the principle, which is likely to be

Indicator card from high pressure cylinder, 60 lb. spring Speed 146. Total I. H. P., high pressure 126.3 E. H. P. 190.

FIG. 1. SOME OBSERVATIONS ON A DIRECT-CONNECTED 300 K. W. MONOCYCLIC ALTERNATOR.

adopted in every city in the country, that everything pertaining to the operation of an electric railway that is in the form of property is taxable.

As soon as the opinion of the Supreme Court had reached the city, the tax commissioner wrote a communication to the city attorney asking him whether the street railway franchises and poles, etc., should be assessed for the year 1894. The tax commissioner stated that the Supreme Court had decided that the power house of the company in the Seventh ward was personal property for the purposes of assessment, and he called attention to the fact that the new law, passed by the Legislature since the assessment for 1894 had been made, exempts the company's personal property from taxation, but makes its real estate liable for state, county and

school taxes. In view of these conditions the tax commissioner asked the city attorney whether the power house should go unassessed as personal property, or should be assessed as personal property, or should be assessed as real estate. He also asked whether the Pabst power house should be assessed in the Seventh ward, where the plant is located, or in the Second ward, in which is located the office of the Pabst Brewing company, where all the business of the lighting plant is transacted.

The city attorney has just given an opinion in which these questions are decided. In the first place, he holds that there can be no reassessment of the street railway property for the year 1894. The Supreme Court, he says, has held in the decision just quoted that the franchises and poles, etc., of the company are personal property for the purposes of taxation, and inasmuch as the company has paid all the taxes upon its real estate for the year 1894, he is of the opinion that a reassessment of its property for the year 1894 is not warranted by law. The Supreme Court, it may be remarked right here, decided in the case in question that the board of review, which might have corrected any error in the assessment, is not a permanent body, but has been dissolved, so that it has lost all control over the assessment, the inference from the Supreme Court's decision being that the new Board of Review had no power in the premises.

Coming to the question concerning the manner of assessing the street railway company's power house, the city attorney announces that he does not agree with the tax commissioner that the Supreme Court had decided that the power house was personal property for the purposes of taxation. He declares that the rule that all property of a street railway company, the use of which is essential to the enjoyment of its franchises, must be taxed as a whole, is destroyed by the new law providing that street railway companies shall pay a license fee based upon their gross earnings "in lieu of all other taxes, assessment and licenses of any such corporation, and all personal property, franchises and real estate owned by such corporation or company shall be exempt from assessment; except that all land or lots unimproved or having buildings thereon owned by any such person, company or corporation, shall be liable to taxation for state, county and school purposes." In view of the action of the Legislature in shattering the doctrine of the taxation of all such property as an entirety, the city attorney holds that there is no apparent impropriety in assessing the various power houses of the company as real estate in the assessment district in which it lies. The city attorney further holds that the power house and the franchises, etc., should be assessed as an entirety, and the assessment must be made in the assessment district in which the corporation which operates the plant has its principal office.

There is still one point in regard to the assessment of street railway property that has not been decided, and that point involves the constitutionality of the new law providing that street railway companies shall pay 1 per cent. of their gross earnings up to $250,000, 1½ per cent. for the second $250,000 and 2 per cent. upon all sums exceeding $500,000. The point is raised that assessments include a levy for special improvements and that it is an impossibility for the Legislature to pass a valid law precluding the collection of taxes for such purposes. If not compelled to pay for sewers, street paving, etc., the company will escape considerable taxation to which it has been liable in the past. The tax commissioner wants to know how the power house and the grounds upon which it stands can be assessed with the franchises, as provided by the Supreme Court's decision, as personal property in the Third ward, where the company's office is located, and as real estate in the Third ward for the other purposes provided by law.

## Municipal Plant of the City of Brussels.

The superficial area of this plant embraces 1,405 square meters, and the buildings comprise the plant proper and the offices of the management.

On the ground floor a space 36 meters in length by 15.50 broad and 8.50 high is occupied by the engine and the boiler room, the latter being 31 meters by 17 meters. On the first floor are the accumulators, the repair shop and storerooms, while over the boiler-room are found the reservoirs, with a capacity of 100 cubic meters, the coal bins with storage for 200 tons, and the purifier with capacity for changing 10,000 liters of water per hour. Coal is received on a swing-bridge and raised by an elevator actuated by a motor as shown in Fig. 3. The stack of the boilers is 56 meters high; its least diameter 2 50 meters.

For each pair of boilers—there will be eight eventually—there is one heater.

Water is purified by the Dervaux system, using lime water and carbonate of soda. The boilers are fed by pumps giving 12,000 liters per hour.

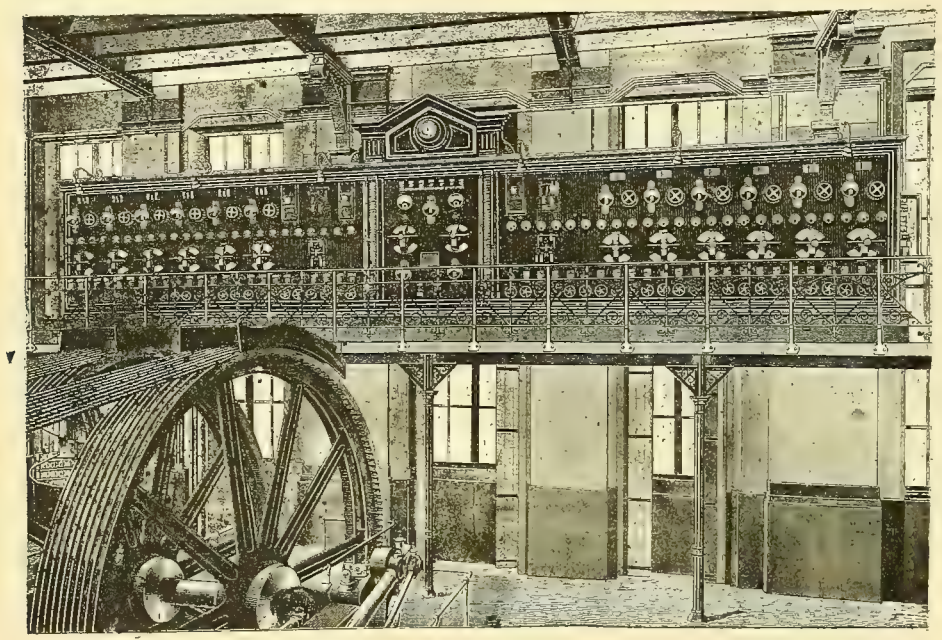


FIG. 1. MUNICIPAL PLANT OF THE CITY OF BRUSSELS.—DYNAMO ROOM AND SWITCHBOARD.

The plant comprises two compound condensing steam engines—one in reserve—of 500 horse power indicated, but capable of exceeding that by 25 per cent. Space is provided for four similar machines. The driving pulleys are six meters diameter with grooves for nine cables of 40 millimeters in diameter. The pulleys weigh 20 tons. Fig. 1 gives a general idea of the magnitude of the installation. Fig. 2 shows one of the four-pole dynamos with drum ring, each having 143 kilowatts capacity, running at a speed of 300 to 360 revolutions per minute, connected by pairs to each of the two engines. At normal speed these develop 1,100 amperes at 130 volts. At 360 revolutions they furnish a charging current at 180 volts of 860 amperes. They weigh 17 tons. There are four collector carriers of bronze, and four brushes of woven copper, the shifting of these being accomplished by means of an endless screw, moved by hand. The current efficiency at the motor is 80 per cent. under full load.

The battery of accumulators comprises 140 elements, the plates weighing 325 kilogrammes each, including the contacts. The total weight of the batteries in place is 80 tons. Space is reserved for a duplicate plant, when occasion shall require. Each element has a capacity of 350 amperes during ten hours. In case of a break-down requiring the installation of a second machine, this battery will furnish a current of 1,400 amperes for 30 minutes.

The 140 elements are arranged to form two batteries of 70 elements each, so connected with the switchboard as to permit of any combination of cells from 44 to 70, for either charging or discharging. The efficiency of the accumulators is guaranteed for a minimum of 70 per cent.

The board at the center of distribution is 3.80 meters high, Fig. 1, and carries all necessary connections for dynamos, accumulators and the service, on the three-wire system. The six engines are so disposed that each will actuate two dynamos at 130 volts, or one at 260 volts when necessary. The two engines now in service each actuate two dynamos. The negative pole of the dynamo No. 1 is permanently connected to the positive of dynamo No. 2. The two poles are connected by a cable with a fuse and ammeter to the neutral bus-bar. The positive pole of No. 1 is connected through a fuse to a large throw-over switch, connecting either to the accumulators or to the bus-bar leading to the positive feeders. The arrangement of the negative of No. 2 is similar. An ammeter shows the output of each dynamo.

The exciter circuits of the dynamos are arranged in shunt as follows: One of the extremities of the circuit of the exciter is attached to the negative pole of the dynamo No. 1, while the other extremity leads to a switch fixed upon the dynamo. This switch is connected to the positive bus-bar of the board through a variable rheostat. A similar connection is made for dynamo No. 2. To suppress the spark of self-induction on opening the exciter circuit, additional resistance is introduced before breaking.

Twenty-four feeders lead from the board, having double-pole switches and rheostats of platenoid, while the third or neutral wires are connected directly to the neutral bus-bar. Tension wires return from each feeder center to a positive and a negative voltmeter, by the aid of which the rheostats are capable of restoring the balance at any time.

Automatic switches are provided which prevent the accumulators from discharging through the dynamos. There are also on the face of the board two voltmeters of six circuits and registering ammeters showing the condition of charge and discharge. Two of these latter are protected by automatic switches which open the lines when the discharge becomes too rapid, as in case of an accident to a machine, when the accumulators furnish all the current.

A varying scale of voltage at the central station has been adopted, which allows for a varying drop according to distance carried.

The cables are of pure copper, according to Matthiesen's table. The conductors are tinned—first covered with a layer of pure rubber, then a layer of vulcanized rubber and a winding of rubber tape, and finally a saturated hemp envelope finishes the covering. The guaranteed insulation is not less than 2,500 megohms per kilometer in water at 15° C., after immersion for 24 hours with a current of at least 500 volts. The cables are drawn into cast-iron pipes with rubber joints. These pipes are from 75 millimeters to 50 millimeters outside diameter. Test boxes are placed at street corners at no more than 80 meters apart. These boxes have iron covers painted with asphalt. The system is underground throughout.

## Cause of Death in Electric Shock [1]

By A. M. Bleile, M. D.

The work here given was undertaken with a view to elucidating the effects of larger quantities of electricity on the organism. Incidentally the value of artificial respiration after death by electricity was also tested. As this is the minor portion of the work, this part will be given first. The data bearing on the subject in general are quite meager, especially as to the amount of current which actually passed through in fatal cases.

In all my experiments dogs were used, and in the subjoined table the weight, voltage, amperage and time are given for each case. In the first experiment 525 volts, 2 amperes were applied for eight seconds; in the second, 220 volts, 1.2 amperes; in the third, 106 volts, .4 ampere, 10 seconds; in the fifth, 96 volts, .35 ampere, two seconds; in the sixth, 52 volts, .3 ampere for one, two and four seconds; in the seventh, 70 volts, .32 ampere, one-half, one and two seconds.

Before the application of the current a canuala was put into the trachea so arranged that it could at once be connected with a bellows for the purpose of giving very complete artificial respiration. Respiration was set up as soon as the current was off and this was continued for periods varying from 20 minutes in the first case to 2½ hours in the last, and in no instance was resuscitation accomplished. Further work was carried on for the sole object of studying the effect of the current.

Our electrodes consisted of oval copper plates three by two inches, covered with sponges moistened with salt water. One electrode was applied at the base of the skull, and the other over the middle of the back, the hair of the animal having been previously well moistened with the salt solution. The current used was the alternating current of 130 periods per second. While the details of each experiment are given in the table subjoined, a few are selected for special presentation. The larger voltages were abandoned for 100 volts, 70 and 50, as near as could be reached.

Ninety-eight volts with .32 ampere was applied first one-half second, then one second with recovery, but in two seconds produced death. Fifty-two volts with .3 ampere was applied one second, later two seconds, with recovery, then four seconds, producing death. Fifty-two volts, .24 ampere, applied three seconds produced death. Fifty-one volts, .12 ampere, four seconds, and 51 volts, .18 ampere, four seconds,

1. Read at the twelfth general meeting of the American Institute of Electrical Engineers, Niagara Falls, N. Y., June 27, 1895.

were not fatal. Fifty-one volts, .2 ampere, four seconds produced death. From these figures and similar ones to be obtained from the table, it is evident that the result depends, somewhat independently of the weight of the animal, on three factors: On the voltage, on the amperage and upon the time of application. A variation of either one of these factors may change the result—that is, a lower voltage with lesser amperage applied for a longer time will have the same effect as a current of higher voltage or more amperage applied for a shorter time. In this connection it was suggested by Professor Thomas that the joules necessary would be found the same in each case, and calculations show that this is approximately true. To prove this absolutely it would, of course, be necessary to work with the minimum

| No | Weight (lbs.) | Volts. | Amperes | Time (seconds) | |
|---|---|---|---|---|---|
| 1 | 21 | 585 | 2 | 8 | Artificial respiration 40 min.—Death |
| 2 | 13 | 200 | 1.23 | 8 | Artificial respiration 25 min.—Death. |
| 3 | 30 | 106 | 4 | 10 | Artificial respiration 1 hr. 15 min.—Death. |
| 4 | 42 | 98 | 4 | 4 | Artificial respiration 2 hrs. 30 min.—Death. |
| 5 | 27 | 96 | 3 | 2 | Artificial respiration 1 hour—Death |
| 6 | 21½ | 52 | 3 | 1<br>2<br>4 | Recovery<br>Recovery.<br>Death |
| 7 | 19 | 70 | 32 | 5<br>1<br>1<br>2 | Recovery<br>Recovery<br>Recovery<br>Recovery |
| 8 | 40 | 47.5 | 25 | 4 | Death |
| 9 | 35 | 96 | 35 | 2 | Death |
| 10 | 30 | 52 | 25 | 2<br>4 | 1-30 grain atropine { Recovery<br>Death |
| 11 | 18 | 52 | 29 | 2<br>4 | 3-60 grain atropine { Recovery<br>Death |
| 12 | 26 | 50<br>97 | 24<br>54 | 4<br>1 | 1-25 grain nitroglycerine { Recovery<br>Death |
| 13 | 30 | 48 | .22 | 4 | 1-20 grain nitroglycerine—Death |
| 14 | 33 | 52<br>104 | 22<br>6 | 4<br>4 | 4-50 grain nitroglycerine { Recovery<br>Death |
| 15 | 27 | 51 | 34 | 4 | 6-50 grain nitroglycerine.—Death |
| 16 | 28 | 47 | 2 | 4 | 1-10 grain nitroglycerine.—Death |
| 17 | 27 | 52<br>106 | 2<br>55 | 4<br>1 | 1-10 grain nitroglycerine { Recovery<br>Death |
| 18 | 36 | 51 | 25 | 4 | 80 grains chloral<br>1-50 grain atropine { Death |
| 19 | 30 | 52 | 24 | 3 | Death |
| 20 | 51 | 52 | 24<br>25<br>30 | 3<br>4<br>6 | Recovery.<br>Recovery<br>Death. (22 deep respirations.) |
| 21 | 25 | 50.5 | 2 | 3 | Death. |
| 22 | 19 | 51 | 2 | 3 | Small dose nitrite of amyl—Death |
| 23 | 17 | 51 | 2 | 1 | Small dose nitrite—Death |
| 24 | 34 | 50.5 | 2 | 3<br>6 | Full dose nitrite { Recovery<br>Recovery |
| 25 | 38 | 50.5<br>101 | 2<br>2<br>5 | 4<br>6<br>1 | Full dose nitrite { Recovery<br>Recovery<br>Death. |
| 26 | 34 | 51 | 12<br>18<br>2 | 4<br>4<br>4 | Recovery<br>Recovery<br>Death. |
| 27 | 12 | 50 | 2 | 4<br>6 | Full dose nitrite { Recovery<br>Death |

quantities as to voltage, amperage and time in each case, and no doubt one or another of these factors will be found in excess in most cases. In these experiments it is of great interest to point out this approximate relation between the results and the absolute amount of mechanical energy used. The results found on post mortem examination of the animals were so uniform that they can be very briefly described. In all cases this examination was made immediately after death, and at first we wished to study the changes produced upon the heart, so that the incision was made through the chest walls and the heart exposed as rapidly as possible. This organ presented the following peculiar conditions. The left side was completely relaxed, the right side was intensely gorged with blood, as were also the large veins in the immediate vicinity of the heart, and the little appendages of the upper portion of the heart were found beating regularly, strongly and synchronously. Pressure on the heart caused a contraction of the other parts, and from this it was evident the death was not due primarily to the destruction of the

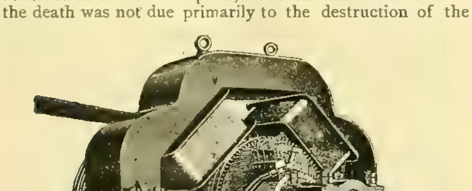


FIG. 2. MUNICIPAL PLANT OF THE CITY OF BRUSSELS.—DULAIT DYNAMO OF 143 K. W.

heart fibers. In addition it was noted that the deep and extensive cuts made in the tissues were free from blood, and that the arteries were quite small and contracted.

This excluded a direct effect upon the heart, and having shown by artificial respiration that the stoppage of this function was not the cause of death, other causes were to be looked for.

It was supposed that the current immediately struck the pneumogastric nerve stimulating those fibers which control the heart in that they have the power of arresting its beat, when strongly stimulated. To test this view, resort was had to the hypodermic injection of atropine, the action of which drug is to paralyze the nerve fibers, and thus prevent their action on the heart when stimulated. In one case $1\frac{1}{30}$ grains of atropine was given, 52 volts with .25 ampere was applied first for two seconds, then for four seconds, and this resulted in death. In a second case $\frac{3}{20}$ grain of atropine was given, 52 volts with .29 ampere was applied first two seconds, then four seconds, again resulting in death. These animals were not therefore rendered more resistant by the drug, and the theory as to the role of the pneumogastric nerve was abandoned.

I now recall the fact already mentioned, that after death incisions into the animal are not followed by bleeding, that the arteries are contracted down to a very small caliber, and that the blood is crowded into the very large veins in the trunk. Taking these facts, it was suggested that the current acted upon the arteries through the nervous center which controls their diameter. It is well known that the arteries are supplied with a middle muscular coat in which the fibers are circular, and their contraction would, of course, cause a narrowing of the artery, rise of the blood pressure, and a consequent impediment of the heart's action; in fact, it has been experimentally demonstrated that the arteries can be constricted to such an extent as to produce a rise of blood pressure which the heart is unable to overcome, and that the circulation will stop from this cause. It is further known that we have in the brain most of the nerve matter whose function it is to control the vaso-motor nerves, the arteries at one time and in one place contracting and thus decreasing the amount of blood; at another time and in another place dilating and thus increasing the amount of blood getting to another particular part. To test this view, that the action of the vascular nervous system was the cause of death, we resorted to the hypodermic use of nitroglycerine. It is known of this drug that it powerfully affects the arterial system, causing, when given

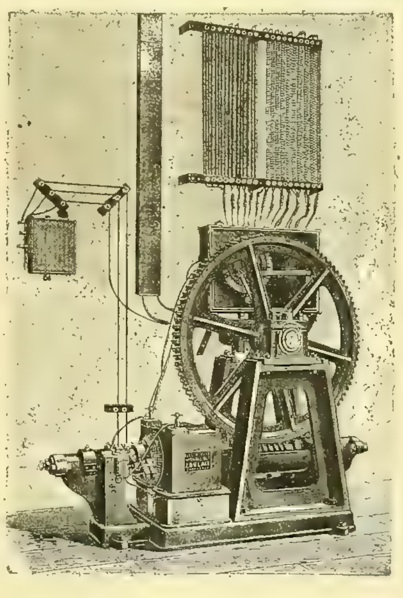


FIG. 3. MUNICIPAL PLANT OF THE CITY OF BRUSSELS.—ELECTRIC HOIST MOTOR.

in larger doses, an extreme dilatation of the arteries, and a consequent great lowering of the blood pressure.

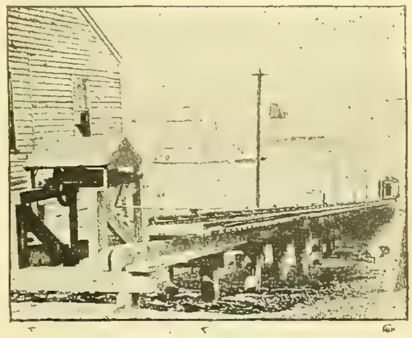
The first animal received $\frac{1}{25}$ of a grain of nitroglycerine, and when the effects were fully established, a current, which was known to be fatal, was thrown in, namely 50 volts, .24 ampere, for four seconds, but the effects produced by this current soon passed off and there was complete recovery. Then 97 volts, with .54 ampere, was thrown in for one second, but this caused death. In another case $\frac{2}{25}$ of a grain of nitroglycerine was used; here 25 volts, .22 ampere, a fatal dose, was thrown in for four seconds with recovery. One hundred and four volts, .6 ampere, was thrown in for four seconds, producing death, but after the current was taken off there was noted eight deep, although irregular, respirations. In other cases where the nitroglycerine was used, there was no apparent effect, but some investigation led me to attribute this to the unreliability of the tablets of nitroglycerine used, and this drug was thus abandoned for nitrite of amyl, a substance which has the same physiological effects as nitroglycerine, but which can be always obtained pure, and the effects of which can be more accurately regulated because it is given by inhalation. In the first case the animal was brought moderately under the influence of the nitrite of amyl, 52 volts with .24 ampere was thrown in for three seconds (this, by the way, being a fatal dose ordinarily), without producing death. Fifty-two volts, .25 of an ampere for four seconds, also a fatal dose, failed to produce death. Fifty-two volts, .3 of an ampere for six seconds, produced death, but after the current was taken off, the animal made 22 deep, regular respirations, though not a trace of the heart beat could be made out, this incidentally proving that stoppage of the respiration is not the primary cause of death.

Three more experiments may be selected—numbers 24, 26 and 27 of the table.

No. 24 was a pointer dog in excellent condition, weighing 34 pounds. Nitrite of amyl was given until the effects were fully marked. Fifty and five-tenths volts with .2 ampere was given for three seconds; after a pause the same quantity was given for six seconds, followed by recovery. Three days later the same dog, who showed no effects at all of the previous treatment, was given—without the nitrite of amyl—51 volts, .2 ampere, four seconds, producing death.

In the last case a dog weighing only 12 pounds and of such general condition of weakness that the assistant protested against his use as not being competent to demonstrate anything, was given a full dose of nitrite, then 50 volts with .6 ampere was applied for four seconds and followed by recovery. The dose applied for six seconds produced death and here again several respirations were noted.

The statements made in regard to the cause of death by electricity are so at variance with one another that it is unnecessary to review them here. Among other plausible reasons it has been stated that the current has a direct disintegrating effect on the brain and nerve tissues and that



ELECTRIC PUMP THAT FOLLOWS THE WATER.

herein is to be found the cause of the fatality. The disintegrating effects of the current on the brain and nerve tissue said to follow are not to be seen microscopically, and the microscopic examination of these organs so far as made by us failed to reveal any change in their structure. It would appear therefore that death in electric shock is entirely due to the fact that the current produces a contraction of the arteries through an influence on the nervous system, and that this constriction of the arteries throws in such a mechanical impediment to the flow of the blood as the heart is unable to overcome, and that, where drugs are given to counteract this effect, much larger doses of electricity than the ordinary can be borne. While artificial respiration may be of value in simple stunning, when larger doses have been taken, no rational means of resuscitation have as yet been suggested.

I was enabled to carry out the above experiments by the loan of apparatus kindly furnished by Professor Thomas and was greatly assisted in the work by Mr. Boyd, of the Physical Department, who was present at every experiment and who made the measurements for us.

The current was obtained from a surface wound alternator giving an approximate sine-curve. For potentials of 100 volts or less, connection was made with the secondary of a suitable transformer. Potentials of over 100 volts were taken directly from the primary circuit, adjustment being made by varying the generator field.

Voltages were measured by means of a Weston alternating current voltmeter. The mains supplying the current were of low resistance, so that the drop when the circuit was closed was found to be negligible. The figures given are the actual potential differences of the electrodes, while the current was flowing through the animal, correct to within one-half volt. A Siemens dynamometer was used for measuring the current when the time of contact was less than four seconds. It was somewhat difficult to make a setting, so that readings for those short times can not be taken as correct within five per cent.

## Electric Pump that Follows the Water.

A novel electrical pumping plant is shown in the accompanying illustration of an installation at Monroe, La., described by the *Engineering and Mining Journal.*

The great variation in height of water in the river rendered it necessary to have a changeable location for the pumps in order that the suction pipe should be always sufficiently submerged. With this end in view a tramway reaching well into the river at low water was built. Upon this tramway, mounted on a four-wheeled truck, a pump house was constructed. This house contains an eight by 10 inch triplex power pump, made by the Goulds Manufacturing company, driven by a 15 horse power slow-speed Westinghouse electric motor.

With the rise and fall of the water the position of the pump house on the tramway is changed by means of the windlass shown at the head of the tramway. This view shows the pump house at the lower end of the tramway, the water being low.

Necessarily in such an installation as this provision had to be made for connecting the pumps and discharge pipe, and this has been accomplished, as may be seen, by extending the main the entire length of the tramway and putting flanged tees at regular intervals.

At these points the connection between the pump and main is made. In order to supply the necessary current for operating the motor a pole line was erected alongside the tramway. On this are strung the wires which carry current to the motors.

This electrical pumping installation is the property of the Monroe Water & Light company, from whose central station the current for the motors is obtained. In spite of the conditions under which the pump is operated and the frequent changes of the pump house, it has been quite satisfactory from the start.

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CIRCULATION, 16,630.

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HE WHO attempts to lead the blind should have tolerably good eyesight, lest he make himself ridiculous. In correcting "the popular ignorance of the terms voltage and amperage" the *Albany Journal* informs its readers that "voltage is stated to be the speed of the current." It would be mildly interesting to know who made this statement and how he came to make it.

STREET railway managers will follow the experiments now being conducted on an underground conduit railway system in New York with more interest than they have given other enterprises in this line, as it appears that in this case the operating company as well as the construction company look upon the project as giving promise of solving the question of electric surface railways in sections of large cities where the trolley would not be admitted. There have been so many projects in this line that have failed in commercial application, that street railway managers have good reason to be skeptical. But the present trial is being made in good faith and by a company that seems to be really desirous of getting such a system. This fact established, the public will await the result of the experiments with interest. The fact that so much attention has been given to the mechanical details would indicate that all engaged in the enterprise realize that something must be done to satisfy the public demand. The promoters of the system say that it will work satisfactorily, but they admit that the cost of construction is far greater than the overhead trolley and that this may prove an unsurmountable obstacle to the success of the project.

AN interesting question has been raised at Evansville, Ind., where the Board of Public Works has been restrained from awarding a contract for street lighting to a company whose bid was not in accordance with the specifications printed. The story is told in another column. The point of interest to electrical men is the attempt to introduce the Welsbach burner in competition with arc lamps for street lighting. The promoters of the Welsbach have learned that for obvious reasons there is no room for the device in interior lighting when considerable light is necessary. That field is already occupied by the incandescent lamp, and all the efforts of the gas companies have failed to dislodge it. It is not to be expected that the Welsbach will find a permanent place in street lighting, although it may be given a trial in small towns, where the rosy-hued claims of salesmen may impose upon the credulous village trustees. But it will not take the taxpayers long to discover that the newcomer's claims are fraudulent, that it is not in reality an economical lamp for such purposes, and this point once established it is bound to be discarded, for no one would think of employing such a hideous form of illumination excepting under the impression that a considerable saving would thereby be effected.

WIRES and insulators which are used in forming and completing the connection between an electric light and power plant and dwellings, stores and other public places for the purpose of conveying or transmitting light and heat thereto, the Court of Chancery of New Jersey holds, in the case of Hughes against the Lambertville Electric Light, Heat & Power company, are fixtures within the purview of a mechanic's lien law, which provides that "any fixed machinery or gearing, or other fixtures for manufacturing purposes shall be considered a building for the purpose of this act," as does the New Jersey statute. The fact that the poles which support the wires along the streets stand upon land, the title to which may be in others, and that the wires which connect the main wires with the several dwellings, stores, and other public places pass into and are fixed to the dwellings and stores and public buildings of persons who were strangers to the company, except as they gave their consent to such erection and the making of such connection, the court further declares, does not alter the rights of the lien claimants, no effort being made by them to enforce the lien against the land upon which the poles are erected, nor against the dwellings, stores or other places into which the connected wires are extended, but only against the plant itself and land upon which it stands. It is this which the lien law here considered makes liable for materials and labor, and not the thing which becomes a fixture.

This decision is interesting in connection with the ruling of the Supreme Court of Minnesota in the case of Capeheart against Foster, to which attention was called in the WESTERN ELECTRICIAN of June 22d. Central station managers, construction companies and supply men should familiarize themselves with these and similar decrees and their application, in order that they may guard against unscrupulous and irresponsible persons who may attempt to prey upon them.

THERE seems to be a tendency among writers of reputation on electrical subjects to adopt a much more conservative course than that formerly followed, and this is nowhere more noticeable than in the consideration of the use of electricity in transportation. Dr. Duncan's paper, published in the last issue of the WESTERN ELECTRICIAN, is an excellent example of the moderate tone that now prevails, and is in striking contrast to the policy pursued in the early days of the trolley, when it was deemed necessary to claim everything in sight. Those who remember the extravagant claims that accompanied the opening of the Richmond line in February, 1888, will look with amazement upon the following paragraph with which Frank J. Sprague closes an article entitled, "Will Trunk Lines be Operated by Electricity?" in the July number of the *Engineering Magazine:*

Let us lay aside, then, some of the visionary prophecies concerning electric railways. Perhaps no one has been more actively identified with them than myself; no one, I think, has greater faith in the future of the electric railway than I; but its future is not in the wholesale destruction of existing great systems. It is in the development of a field of its own, with recognized limitations, but of vast possibilities. It will fill that field to the practical exclusion of all other methods of transmitting energy; it will replace the locomotive on many suburban and branch lines; it will operate almost all street railway systems and elevated and underground roads; it will prove a valuable auxiliary to trunk systems; but it has not sounded the death knell of the locomotive any more than the dynamo has sounded that of the stationary steam engine. Each has its own legitimate field which will play its proper part in the needs of all civilization.

The change in tone which is here so strikingly illustrated is certainly encouraging, and the tendency which it marks should be cultivated, as its general adoption will be commended by all thoughtful men. Dr. Duncan and Lieutenant Sprague are not one whit less positive in their belief in the great future of the electric motor in railway work because they are temperate in their utterances and do not allow their enthusiasm in its advocacy to outweigh their cooler judgment as engineers and experts.

MANAGERS of street railways introducing improved methods of propulsion on their lines, by which it is possible to give better service, should profit by the experience of those who have already accomplished this transformation and avoid the trouble and annoyance that were in a measure inevitable in the pioneer work. There is no excuse to-day for any street railway company employing incompetent motor and gripmen. When the first cable and electric lines were equipped it was necessary to employ men who were not familiar with the operation of cable and electrical apparatus, and, as might be expected, many serious accidents marked the opening of these roads. The people of Chicago will not forget their first year's experience with the cable roads, especially the North Side system, which aroused opposition as great as that manifested by the people of Brooklyn and Philadelphia against the trolley lines. Repetition of these accidents to-day is only avoided by constant watchfulness on the part of the company. The same care must be exercised in the operation of the electric lines which now form such an important part of this company's plant. None but experienced men should be placed in control of motor cars. Moreover, these men should be of a higher degree of intelligence than those generally employed as drivers on horse cars, from which, in many cities, the ranks of motor and gripmen have been recruited. The idea so prevalent that an electric motor, whether in a factory or on a street car, requires no attention, must be modified. True, if started it will run itself, but the result is liable to be disastrous. Mr. Yerkes should instruct the men in charge of the operation of the road, the superintendents and their assistants, to employ none but competent men for handling motor cars and not to place any man in charge of a trolley car who has not been thoroughly instructed in its operation and drilled in the manipulation of the devices by which the motor is controlled. Great care should be exercised by these employes, too, at street crossings and in turning curves. This is a point that is not fully appreciated. Conductors, gripmen and motormen apparently delight in jolting passengers over crossings and violently plunging them headlong into the aisles of the cars in rounding curves. All such practices should be severely rebuked by the company, for their continuance not only subjects passengers to great annoyance but places them in constant danger. In order to prevent serious accidents the company should preserve perfect discipline among employes, exacting close attention to minor details as well as matters of greater importance. One much needed reform is in the prevailing custom of racing over a cross street upon which there is a car line. This practice, by the way, was primarily the cause of the first accident on the North Side electric lines. According to the most satisfactory reports, an electric car was going east on North avenue near the intersection at Wells street when a Wells street limits car, going south, appeared at the crossing a few feet distant. The grip car succeeded in getting over the crossing, but the electric car struck the trailer squarely in the middle, knocking part of the flanges off the wheels. The cable train continued nearly 100 feet south of North avenue with the trailer off the tracks. Upon this statement of the case, which by the way seems to be complete and accurate in every particular, it is evident that both the gripman and motorman were at fault, as they did not have their cars under control. Both should be dismissed. It is just such reckless conduct that has brought the trolley into ill-repute in other places, and that will make it feared and shunned by the public in Chicago and elsewhere if these irresponsible employes are not held in check. Street railway companies must impress on their employes the importance of their positions—that of a motor or gripman being not one whit less responsible than that of a locomotive engineer. And, by the way, it might be opportune to mention that competent men, faithful to the interests of their employers and mindful of their duty toward the public, can only be secured and retained by companies paying fair wages and dealing justly.

## Storage Batteries for Telegraph Work.

By Maurice Barnett.

As an economical substitute for primary batteries in telegraph, police, fire alarm telegraph, railway signal and burglar alarm systems, storage batteries are coming more and more to the front, and are threatening to displace, in locations where charging current is available, the cumbersome, primitive, and consequently unsatisfactory gravity cell which for years and years has been the chief source of electric power used in these systems. This change has come about naturally, as a result of comparisons between the economies and efficiency of these classes of cells. A consideration of the relative first cost and maintenance cost, the performance, and the floor space required by primary and secondary batteries respectively, will indicate how indubitable are the advantages possessed by the latter for this kind of work.

In order to get at the relative first cost of primary and secondary batteries the most satisfactory method will be to take the number of accumulators of given size in certain stations thus equipped and compare that with the number of gravity cells displaced. We find the following list of Western Union Telegraph offices equipped with chloride accumulators and the number of gravity cells which these have displaced:

| *Western Union Office at—* | *Number of Chloride Accumulators in Use.* | *Capacity of Cell.* | *Number of Gravity Cells Displaced.* | *Purpose Required* |
|---|---|---|---|---|
| 21 Cortlandt Street, New York | 1 | 100 ampere hours. | 30 | For "local" working. |
| 120 Front Street, New York | 1 | 100 " | 22 | For "local" working. |
| 16 Broad Street, New York | 1 | 100 " | 56 | For "local" working. |
| Central Railroad Building, New York | 1 | 75 " | 24 | For "local" working. |
| 50 Broad Street, New York | 2 | 100 " | 75 | For "pony" wires. |
| Consolidated Exchange, New York | 1 | 75 " | 33 | For "local" working. |
| *Sun* Office, New York | 1 | 100 " | 72 | For "local" working. |
| 16 Broad Street, New York | 2 | 100 " | 60 | For "pony" wires. |
| *World* Office, New York | 1 | 100 " | 28 | For "local" working. |
| 319 Greenwich Street, New York | 2 | 100 " | 30 | For "local" working. |
| 9 New Street, New York | 2 | 75 " | 104 | For "local" working. |
| Produce Exchange, New York | 2 | 100 " | 56 | For "local" working. |
| Central Railroad Ferry House, New York | 1 | 12 " | 8 | For "local" working. |
| Main Office, Brooklyn | 1 | 100 " | 18 | For "local" working. |
| Main Office, Jersey City | 1 | 75 " | 10 | For "local" working. |
| Central Railroad Depot, Jersey City | 2 | 100 " | 58 | For "local" working. |
| Central Railroad Depot, Jersey City | 96 | 12 " | 401 | For "main line" working. |
| W. S. R. R., Weehawken | 1 | 150 " | 32 | For "local" working. |
| W. S. R. R., Weehawken | 68 | 12 " | 330 | For "main line" working. |
| Allentown, Pa | 48 | 6 " | 120 | For "main line" working. |
| Easton, Pa | 90 | 6 " | 450 | For "main line" working. |
| Scranton, Pa | 252 | 12 " | 860 | For "main line" working. |
| Scranton, Pa | 42 | 6 " | 84 | For "main" intermediate. |
| Bridgeport, Conn | 225 | 12 " | 415 | For "main line" working. |
| Hartford, Conn | 240 | 12 " | 820 | For "main line" working. |
| Hartford, Conn | 240 | 6 " | 480 | For "main" intermediate. |
| Hartford, Conn | 6 | 100 " | 200 | For main, locals and motor. |
| Long Island Railroad Depot, Long Island City | 100 | 6 " | 150 | For "main line" working. |
| Long Island Railroad Depot, Long Island City | 4 | 100 " | 50 | For locals. |
| 26 Exchange Place, New York | 2 | 50 " | 16 | For locals. |
| Pennsylvania Railroad Depot, Jersey City | 1 | 50 " | 12 | For locals. |
| 16 Broad Street, New York | 40 | 6 " | 100 | For "pony" wires. |
| Atlanta, Ga. | 344 | 75 " | 8,000 | For main line only. |
| Atlanta, Ga. | 172 | 50 " | .... | For main line only. |
| Atlanta, Ga. | 172 | 25 " | .... | For main line only. |
| Atlanta, Ga. | 12 | 250 " | .... | For locals. |
| Long Branch, N. J. | 200 | 6 " | 400 | For main line. |

An addition of the two columns, (1) "Number of Chloride Accumulators in Use," and (2) "Number of Gravity Cells Displaced," shows that 2,392 secondary battery cells were capable of performing the work of 13,007 primary battery cells. As near as can be ascertained, the cost of the accumulators was $6,071.50, as against $7,804.20 for the gravity cells. These prices are for the elements, electrolyte and connections for these two classes of cells, but do not include cost of auxiliary apparatus for the accumulators, or battery stands. With regard to the cost of the former this will depend on the source of the charging current. If this were a current from a trolley wire, a motor-generator, switches and recording instruments would be required in addition to the battery. If no electric current were at hand, but mechanical power was available, a small dynamo with suitable switches and recording instruments would be required for charging battery. Ordinarily, however, the cells may be charged from any local incandescent lighting plant, when the only auxiliary apparatus needed would consist of suitable lamp or other resistance, switches and recording instruments. As each installation has certain conditions peculiar to itself, which govern the nature of the auxiliary apparatus required, no precise statement can be made regarding expense for additional apparatus needed in installing secondary batteries. In any case this is not a formidable figure. Even allowing 15 per cent. in addition to cost of battery to go toward account of accessory apparatus, the cost of accumulator installation would still be well within that of primary batteries. On the other hand, as accumulators require considerably less than one-tenth the floor space required by primary batteries, the cost of installing the latter is considerably greater so far as the stands are concerned. This enables the friends of accumulators to made a good showing in any comparison of cost for installing these two classes of cells.

Regarding cost of maintenance of primary batteries and accumulators the showing is even more favorable to the accumulators. Estimates differ as to cost of material consumed yearly in a gravity cell. An authoritative statement on this point, published some time since in the *Telegraph Age*, gives the cost of maintenance at $1.10 a year. J. B. Stewart, superintendent of telegraph of the West Shore Railroad company, in a paper read at the convention of the Association of Railway Telegraph Superintendents held at Montreal, Quebec, June 12th and 13th of this year, gave as the cost of maintenance of the gravity batteries used in the West Shore Railway telegraph system $1.65 per cell per annum. Assuming that the average of these figures is correct, we may put the cost of maintenance of these cells at $1.37½ per cell per annum. The cost of maintaining accumulators is the sum of the cost of charging current plus interest on first cost plus depreciation of cell. The cost of charging current will vary according as it is bought from an electric light or power company or furnished by the regular light or power plant at the telegraph station. In the latter case the cost is practically nil. Speaking of this, Mr. Stewart, whose paper we have already cited, says: "There is practically no expense for charging—the amount of coal used is just the same as before the battery was put on and the ammeter is not deflected when the battery is switched in or out—in fact, we cannot detect that the feeding of these cells has added anything to the load of the machine." C. F. Annet, superintendent of telegraph of the Illinois Central Railroad company, Chicago, says, in a paper read at the Montreal convention: "The current absorbed by the charging batteries is not enough to materially affect the light given by the lamps, and as it is furnished by our own lighting plant the cost is hardly sufficient to justify the estimate." As not all companies have their own lighting plant from which to get cheap charging current, we may take as a basis the cost at which this current could be bought from regular electric light companies. From two independent sources it is found that an amount of current equivalent to that furnished by a gravity cell during one year can be bought for 9 cents. Add to this 2½ cents for interest on equivalent accumulator cell and 2½ cents for depreciation of such cell, and we have approximate cost of maintaining accumulators, even under unfavorable conditions, at 14 cents a year, as against $1.37½ for the maintenance of the gravity cells.

Regarding floor space required for the primary and secondary batteries, we can do no better than publish the testimony of J. B. Stewart: "Prior to the installation of this plant (the chloride accumulator plant now in use) we had two banks of main battery of the gravity type, one of 140 cells, another of 50 cells, and one also of 48 cells for locals. These batteries required a room 12 by 12 feet; our present main battery of 70 cells (chloride accumulators) is kept in a closet five feet long, four feet wide and 10 inches deep and located in the dynamo room."

The explanation of the low first cost and small floor space required by the secondary batteries, as compared with gravity cells, is to be found in the circumstance of the high ampere capacity of the former type of cell—acquired both by large amounts of active surface in each cell and low internal resistance. Besides, the electromotive force of the accumulator cells is two volts, or double that of the gravity cell, which further increases the efficiency of the former over the latter type. The high ampere capacity and the practically constant electromotive force of accumulators pre-eminently adapt them for telegraphic work, especially for local circuits, for on account of these qualities it is possible to operate a large number of local circuits from the same cell without having the fluctuations on any line or lines interfering with the proper working of the others. It is well known that with the low-capacity gravity cells it is impracticable to operate more than a few lines from each cell, and even then fluctuation on any line is sure to produce disturbances on the others.

The Western Union Telegraph company installed its first storage battery about two years ago by putting in a single cell at the office, 21 Cortlandt street, New York city. This cell was charged by a current sent through a wire from the main office. The discharge of the cell furnished current for operating 12 local circuits, displacing the 30 gravity cells which had previously been used for this work. Since then the Western Union Telegraph company has installed accumulators in many important stations, the largest installation being at Atlanta, Ga., where 8,000 gravity cells were displaced. The Postal Telegraph Cable company has also begun to substitute accumulators for primary batteries. Last, but not least, the fire-alarm telegraph companies are recognizing the economy of secondary over primary batteries and are installing the former in many alarm systems throughout the country.

By reference to the table showing the number and size of accumulators in use by the Western Union Telegraph company, it will be noticed that the ampere hour capacity of the cells used on the main line is very much less than that of the local circuit cells, though in number they greatly exceed the latter. The explanation of this is found in the fact that the current on the main line is not used for "energizing" the receiving relay instruments, and although many lines may be operated from the same main circuit battery, the amount of current required does not, as a rule, reach more than one-eighth the amount required for supplying local circuits. On the other hand, it has to have a very high electromotive force to be enabled to overcome the resistance of the main lines. On local circuits the resistance is very small, hence a single cell will furnish sufficient pressure to force the current through these lines, while the fact that from 12 to 20 local instruments are worked off such a cell necessitates giving to it a large ampere capacity. Speaking generally, it may be said that for main line work a current of .04 ampere per relay is sufficient, while for local circuit work, for each relay, from five to eight times that amount is required. For local work there is also the proportionately larger number of instruments at work.

The number of cells and capacity required to perform a given work on local and main line circuits is ascertained as follows: Taking local circuit work first, suppose it be required to know the ampere hour capacity of a battery to operate a certain number of instruments for a certain number of hours on each charge. The rule is: Multiply the number of instruments by the current required for each and the product by the number of hours battery must discharge. To ascertain the number of cells to be placed in series, multiply resistance of each instrument by current required to operate it and divide product by two. In practice, however, a sufficient margin is allowed over and above the theoretical capacity as a safeguard against the variations in daily work. Thus if theoretical considerations led to the conclusion that a 36 ampere hour cell at 1.25 volts was needed, it would be well to put in a cell of 50 ampere hour capacity. This would furnish current for 50 ampere hours at a pressure of two volts. For main line work the rules are practically the same. For capacity, multiply the number of lines by current required on each line and the product by the number of hours battery is to be worked on one charge. For number of cells in series: Multiply current required on each line by resistance of such line and divide product by two. As before stated, a sufficient margin will have to be allowed for variations in daily work. Thus if theoretical considerations led to the selection of 120 cells of 7.2 ampere hour capacity each, experience would dictate using say 120 cells of 10 ampere hour capacity each.

In conclusion, it may be stated that it is only a matter of time when accumulators will displace gravity cells in locations where a charging current is available. The grounds for such a conclusion are to be found in the advantages which accumulators possesses over primary batteries. These are: First, that the first cost is less; second, that cost of maintenance is about one-tenth; third, that floor space required is about one-tenth; fourth, that electromotive force and internal resistance are nearly constant; fifth, that numerous circuits may be worked off the same cell or group of cells; sixth, that evaporation of electrolyte is small; seventh, that there are no corroded connections; eighth, that there are no "creeping salts;" ninth, that the only attention required is to see that the battery receives the proper charge.

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The Ottawa, Ont., Electric Railway company, of which T. Ahearn is managing director, makes a fine showing in its annual report. For the year ended May 31, 1895, the gross revenue was $193,991.36 and the total expenses $122,335.67, leaving a net profit of $71,655.69, or about 10½ per cent. on the average paid-up capital stock. During the year 8 per cent. was paid in dividends and $16,570.37 was carried forward to the credit of the profit and loss account. The percentage of expenses to receipts was 63. The profit per car mile was 5.61 cents and the profit per passenger carried 1.60 cents.

## Manistee Steam Pump.

The improved steam pump illustrated by the accompanying cuts was designed by R. L. Frost, M. E., and is manufactured by the Manistee Iron Works company of Manistee, Mich. Mr. Frost has had much experience in designing and constructing steam pumps, and he considers that the Manistee pump has new and valuable features.

Fig. 1 shows the general appearance of the boiler-feed pumps. Pumps for other purposes have the same special features, although the general appearance may vary. The steam chest is placed on the side of the steam cylinder, and the ports run to the bottom of the cylinder, as shown in Fig. 2; this causes any condensation from the steam to be automatically ejected with the exhaust at each stroke, thus doing away with the necessity for pet cocks. On this account, when the pump is set to run at a certain number of strokes per minute, it will continue to run at that speed without any care to draw off the condensation, which in most pumps would cause them to slow down if not attended to when running slow.

Fig. 3 shows a cross-section horizontally of the steam cylinder with the valve in position as when admitting steam to drive the piston to the right, and Fig. 4 shows the vertical section through center of pump. The steam is admitted to the pump at *V* and passes through ports *P* and *P'*; thence through port *M* in valve; thence through ports *S* and *N* into left-hand end of steam cylinder *A* at bottom. Each end of the cylinder is exhausted, respectively, through the ports *N* and *N'* into the exit port *O* through the exhaust cavity, or reduced central portion of steam valve.

There is only one steam valve, and this valve has no mechanical connections with other moving parts of the pump, but it is actuated by live steam passing through the passage *F* in the trip tube *Y* and crosshead and hollow piston rod, and thence into groove *I* around piston; when this groove reaches the proper point near the end of stroke it passes over a small port *H*, which allows enough steam to pass into the steam chest to trip the steam valve and reverse the stroke. This arrangement gives the pump a positive, full stroke, as it cannot reverse until the piston reaches the end of stroke so as to allow the steam to pass through the port *H*.

The tappets *T* are only for use in starting the valve should it refuse to move when steam is first turned on, because of cold water in the steam pipe or other cause.

The steam valve is also a perfect automatic governor, regulating the steam admitted.

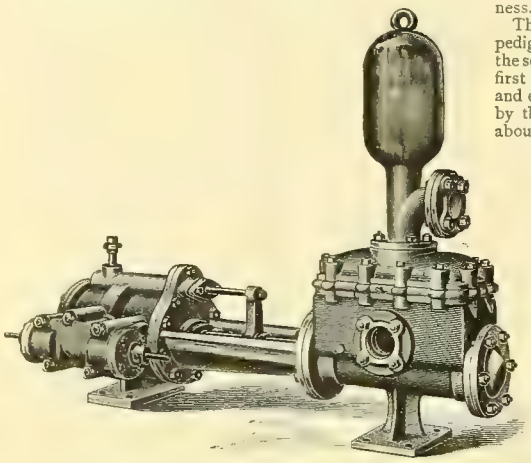
The governing element of the steam valve is in the steam-cushioning chambers *W''* and *W'''*. While valve is passing from left to right a portion of live steam from port *P'* enters the chamber *W''* through a reduced portion of valve body near the head *K*, and is confined in said chamber and compressed by the pressure of steam in chamber *W* on the larger area of the outer end of valve head *K*.

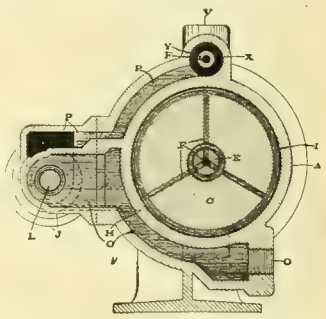
When the steam piston *C* meets a higher resistance, the pressure of steam driving the same is correspondingly augmented, and the cylinder being connected to chamber *W* by the port *H*, the pressure in said chamber is likewise augmented, which tends to move the valve farther to the right and open the steam port *M* farther and increase the flow of steam to the cylinder, and at the same time compress the confined steam in the innerend of chamber *W'''* to a very high pressure.

When the resistance to the steam piston is lessened the pressure of steam driving it will be correspondingly reduced, and the compressed steam in chamber *W'''* is allowed to force the valve to the left, reducing the opening of port *M* to the proper size to admit only enough steam to drive the piston against the reduced resistance.

By this arrangement the supply of steam is automatically increased or reduced to suit the resistance, which causes the pump to run at a uniform speed under all conditions and to reverse quickly, quietly, and without jar or vibration, and also makes it impossible for the pump to run too fast or strike the heads, even should the supply to the suction suddenly give out or the load be suddenly taken off while the throttle is wide open.

The steam valve does not reciprocate rapidly while admitting the steam as it does in some makes of steam actuated pumps, but makes one movement of sufficient length to give the proper steam port opening to suit the load, and stands there until reversed for the return stroke. This fact, together with the fact that the valve has only its own weight bearing it against the face, makes the valve very durable. There are no inside packed stuffing boxes, but all are outside where they can be easily looked after and kept tight.





FIGS. 1 AND 2. MANISTEE STEAM PUMP.

The water cylinders are made either with or without brass linings, and are so arranged that brass lining can be put in at any time if desired. The water pistons are of cast iron or gun metal, with fibrous packing, or solid pistons water packed, if for pumping hot water.

All parts are made interchangeable, and in case of breakage a new part can be quickly substituted for the broken one. These pumps are made extra heavy and strong and average 20 per cent. heavier than other makes of similar sizes.

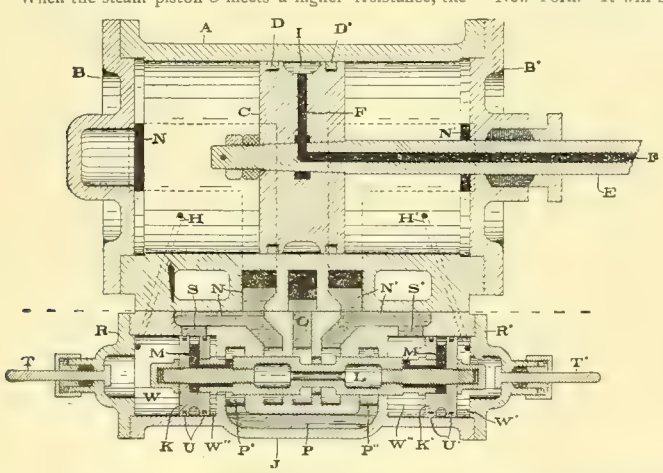
## American Branch of F. Hardtmuth & Co. of Vienna, Austria.

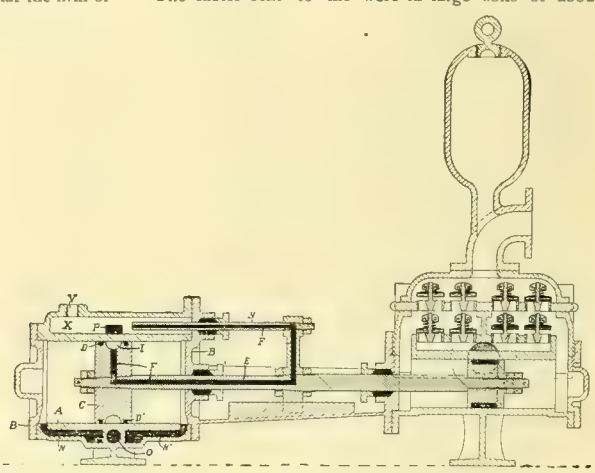
F. Hardtmuth & Co., electric light carbon manufacturers of Europe, have opened a branch office at 60 Liberty street, New York. It will be interesting to know that the firm of F. Hardtmuth & Co. was established as far back as 1880, when arc lighting was in its infancy, and it can be justly called the pioneer of the carbon industry. It was 'way back in the seventies that the well known Frenchman, Monsieur Carre (whose work in the electrical science did so much to help its advancement), made carbons by sawing them out of the blocks of gas retort carbons, but which was a very tedious process, outside of the fact that such carbons contained many foreign and impure substances. A little after this time Fritz von Hardtmuth, a prominent chemist, turned his attention to the subject, and after two years of hard study and experiment established, with his brother, Maurice von Hardtmuth, a factory in Vienna. It was not long before the merits of their carbons were known, and to-day there is hardly a place on the globe where there is arc lighting that their carbons are not in use. Old-timers in the electrical profession can no doubt remember the praise bestowed upon the Hardtmuth carbons at the exhibitions of Paris, London, Munich, Vienna and Turin, while at the World's Fair in Chicago they received the diploma of honor.

The Hardtmuth factory was increased from time to time as the demands upon it increased, so that to-day it is one of the largest of its kind, and it may be mentioned that the firm is now building apother one in Germany, which will soon be in operation. Outside of being an expert chemist, Fritz von Hardtmuth is also a mechanical genius, having invented many labor-saving appliances that are used in connection with the carbon manufacture, so that to-day the prices of carbons have so decreased as to bring them within reach of all that desire a good and steady light, while formerly only gilt-edged concerns used them. M. von Hardtmuth, before he went into partnership with his brother, was a prominent figure in his uncle's works at Budweiss, where the great lead-pencil works are situated, and it may be mentioned that a great deal of the success of the carbon works is due to his executive ability in handling the business.

The Hardtmuths are well known in Austria, and their pedigree can be traced back to the fourteenth century. In the seventeenth century they were associated with Faber, the first lead-pencil maker in Germany, but later on separated and established the Budweiss factory, which is still retained by the Hardtmuths. That fine old castle on the Danube, about one hour's drive from Linz, facing the Crags on the opposite bank of the river, and which has many a time been a subject for artists' sketches, is the paternal home of the Hardtmuths.

The New York office of this concern will be in charge of Francis Jehl, who will be remembered as one of the pioneer electricians of this country and one of Edison's assistants at Menlo Park thirteen years ago, after which time he went to Europe and had charge of the Edison electric light meter in England, France and Italy. In 1882 he installed the first theater that was completely lighted by electricity, at Brünn, and several other important places of amusement through Europe. He is an inventor of a number of important electric appliances. His large circle of friends will wish him success, upon his return to America.





FIGS. 3 AND 4. MANISTEE STEAM PUMP.

## Report of Dr. Fleming on Okonite.

Following are extracts from the report of Dr. J. A. Fleming, F. R. S., professor of electrical engineering in University College, London, England, under date of December, 1894, to Laing, Wharton & Down, 82*a* New Bond street, W., London:

The cables sent to me were in large coils of about half-mile lengths, and came just as they were forwarded by the makers. * * * I have found in this Okonite cable a very marked increase of insulation resistance with time of charging, and have, therefore, given all the results in the form of curves on a chart appended to this report, in which the insulation resistance of the samples is shown in megohms per mile of cable after one to five minutes' charging. * * * My opinion of these cables is, therefore, that the Okonite material is a remarkably good insulator, and that the samples of Okonite cable submitted to me represent a very high degree of excellence in the manufacture of insulated cable. I do not lay much stress on mere megohms per mile in a cable. The real practical test of a cable is the electrical pressure it will withstand after prolonged soaking in water and such general rough usage as the cable will experience in actual handling. In order to test the mechanical toughness of the Okonite material, I bent and kinked several samples at such sharp angles as to break the copper strand inside the

Okonite insulation. This mechanical toughness combined with its flexibility is a great point in its favor.

I consider that this Okonite cable is a very excellent and high class cable for all outdoor, overhead, or underground electrical work, with high electric pressures, whether alternating or continuous.

I regard it also as an excellent material for indoor wiring work, in cases in which the conductors are necessarily exposed to moisture and under conditions in which a very large factor of safety must be employed. The standard copper conductor, being tinned and twisted, was not in a form suitable for a very accurate test of the copper conductivity, but the figures given for the resistance per mile of the coils A, B and C, show that the copper employed is not less than 98 per cent. conductivity in all probability.

I consider that the behavior of these samples of Okonite cables places it in the front rank as a class of cable for electric lighting and transmission work.

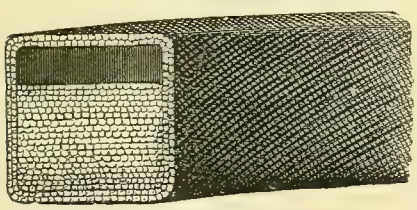
Under date of February 15, 1895, Dr. Fleming writes as follows: The next question to which I have directed my attention is the power of the Okonite material to withstand the action of chemical agents. For this purpose fair samples of the Okonite cables were put to soak on January 12, 1895, in the following chemical solutions: (a) was put into strong salt and water; (b), parafine oil; (c), linseed oil; (d), caustic soda solution; (3), dilute sulphuric acid, 1.10 or battery acid. These samples were left soaking in these solutions until February 18th, or for 34 days. They were then tested for insulation at 100 volts and found to be in excellent condition. The samples were then submitted to the electric pressures test, the pressure being taken up at 3,360 volts by the use of an alternating current having a mean pressure of 2,400 volts, and all of these showed no signs of failure when exposed to this pressure for five minutes.

This forms an exceedingly severe test of the high insulating quality of Okonite, that after this soaking in oils, brine, acids and alkali for more than a month all the samples withstood 2,400 alternating pressure perfectly.

I have no hesitation, therefore, in saying that I think the Okonite insulation is a remarkably fine insulating material and one which by its electrical and mechanical qualities is well fitted for use in electric cables for high or low pressures. I have not found that the severe cold of the last month has rendered it at all brittle.

## Garlock High Pressure Packing.

It is but a few years since that steam at six atmospheres was considered a high pressure and was about the limit on steam plants. To-day, on the modern steam plant, with



GARLOCK HIGH PRESSURE PACKING.

triple expansion or compound engines, 150 pounds is a common pressure, and on many of the larger engines a pressure of 225 pounds is used. The Garlock Packing company of Palmyra, N. Y., has produced a high pressure packing, made of selected fiber and metal, in combination with the Garlock packing compound, which has successfully withstood the trials and hardships of stuffing-box life on the largest engines for many years. This packing, shown in the cut, is especially adapted to high pressure work on locomotive, stationary and marine engines. The construction is without question designed to insure long service. The material is made in sixteenth and eighth sizes, from one-fourth of an inch to two inches square.

## Slowgoing New York.

[From the New York *World*.]

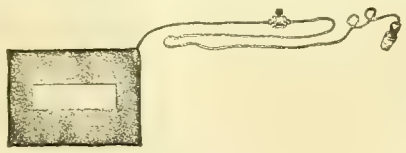
When the people of Chicago boast of the achievements of their city New York is apt to look on them with that pity which springs from the consciousness of superiority. But it must be confessed that at least in the matter of providing public facilities and accommodations of various kinds Chicago and other cities are able to do things which seem impossible of accomplishment in New York. It is not pleasant to read, for instance, that the Lake Street Elevated Railroad company of Chicago has made a contract to equip its line with electricity and that the motors which are to be furnished within 60 days are to be duplicates of those already in use on the Metropolitan elevated railroad in the same city. The laws of nature are the same in Chicago and in New York, and a method of traction which can be profitably operated there would be equally available here. But while the second Chicago elevated road is making its contract for electrical equipment our "L" road managers are "considering the question," a performance they have been engaged in for many years. New York was the last of the great cities of this country to get rid of the street-car horse in favor of a better method of surface traction. Is it also to be the last to adopt electricity in any form of rapid transit?

The Greenwich & Schuylerville, N. Y., Electric Railroad company has been incorporated to construct a street surface road from Greenwich, Washington county, to Schuylerville, Saratoga county, a distance of six miles. The capital stock is $200,000, divided into 2,000 shares.

## Electric Heating Pad.

One of the latest advances in real electro-therapeutics is the production by the H. W. Johns Manufacturing company of the electric heating pad shown by the cut. The trade name "electrotherm" is adopted, and the device is simply a flexible sheet or pad of asbestos, in which is embedded wire of sufficient resistance to produce a constant and uniform degree of heat when attached by lamp cord to an incandescent socket or other source of current.

This pad will be found a great convenience in relief of general chilliness, cold feet, etc., as well as cramps and other local pains. By its use the risk and discomfort of frequent changes of temperature incident to the renewal of ordinary



ELECTRIC HEATING PAD.

hot applications are entirely obviated. It can be moistened without injury, but when the effect of a poultice or moist heat is desired it should be applied over one or two thicknesses of wet flannel. It can be safely used by anyone, and the simplicity and convenience of this means of applying heat render it especially valuable for medical use.

The cost of maintaining a constant heat in this pad is said not to exceed one cent per hour. The electrotherm is made for any voltage, from five to 125, and can be used with either direct or alternating current. The voltage required is printed on each article. By the use of a newly patented switch, the temperature can be regulated to almost any desired degree; the regular heating pads can be thus maintained at approximately 130°, 170° and 220° Fahrenheit, when covered with ordinary bed clothing, but these temperatures can be modified by the interposition of a blanket. For general use the electrotherm is supplied in pads 11 by 15 inches, one-quarter inch thick, with regulating switch, plug and 15 feet of conducting wire.

## Telephone Rates in Milwaukee.

[From the Milwaukee correspondent of the WESTERN ELECTRICIAN.]

New telephone rates, long promised, have gone into effect in Milwaukee. The principal reduction is that of the standard rate, on a basis of 1,000 calls within a radius of three-quarters of a mile of the telephone exchange, from $90 to $75 a year. Practically this is a reduction of $15 a year in the rate for telephones in the down-town business section of the city. The charges for all calls in excess of 1,000 a year are the same as they have been for some time. Under the schedule now in force every subscriber pays $10 additional for every quarter of a mile beyond this limit, so that a person whose telephone is 1½ miles from the exchange has to pay $120 a year. Under the new schedule the rate is $75 a year for the first mile and $20 a year for the additional half mile, so that the rate makes a saving of $25 a year, and of course there is a similar reduction in the rates for telephones two or more miles from the exchange.

Under the old rate a man could not have a telephone with a metallic circuit at his residence for less than $90 a year. The new rate is $50 a year for private residences, the telephones to be provided with metallic circuits, but the usual extra charge will be made for all calls in excess of 1,000 a year.

A device by which two persons can have telephones on one line, without ringing both telephones, has been adopted by the company. One instrument is shut off while the other is in use. The rate for this is $40 a year. The rate for a clock-line telephone has been reduced from $50 to $45 a year. Hitherto the company has published in its directory only the names of persons who were paying the full rates. Now anybody can have his name published in the telephone directory by paying $20 a year, so that two or three persons in the same office, for instance, can enjoy all the privileges of telephone subscribers upon paying $20 a year, provided that there is a telephone in the office to begin with, for somebody must pay the full charge of $75 a year. A committee of directors of the company worked for some time on the new schedule, and they claim that the new rates are among the lowest in force anywhere in the country.

The establishment of sub-exchanges is a most important matter that has been decided upon by the company. It is projected to establish three or four such exchanges during the coming year, the first one to be on the South Side. These sub-exchanges, it is claimed, will greatly reduce the cost of the telephone to people who live any great distance from the central exchange. Each sub-exchange will of course, be connected by cable with central exchange. The rates of subscribers who depend upon the sub-exchanges will be figured upon the same basis as the rates of subscribers connected directly with the central exchange; that is to say, subscribers who live or have their office within three-quarters of a mile of the sub-exchange will pay only $75 a year and $20 a year additional for every half mile above the limit. The directors of the company think that this plan will greatly increase the use of the telephone.

## Government Telephone Service.

[From the Washington correspondent of the WESTERN ELECTRICIAN.]

The Interior Department will hereafter use its own telephone system, the new service having been formally turned over to it. The contract has been filled by the Western Telephone Construction company, Chicago. For the most part the apparatus is that of the Hunning transmitter. A somewhat amusing incident occurred the other day in connection with this service. It was before the lines were working smoothly, and a substitute operator was at the main switchboard when Central was called up by a lady who desired "to see" one of the officials. "Strictly official business," she said, but somehow the operator could not get connection with the official in question. The lady did not understand the trouble and rang for about fifteen minutes. When the situation was finally explained to her she ceased ringing, but evidently continued with her ear to the receiver at her end of the line. The operator forgot to turn the key which shuts of the sound and a few moments later when he had related the story as a joke, he added to his companion: "Just bet the woman was not on 'strictly official business,' but a sweetheart or wife of the official, who wanted him to take her out to lunch or some other place of amusement." "I hear every word you say," suddenly came a voice out of the telephone, "and I am going to report you." Evidently she did not, however, for nothing was heard of the matter, but hereafter all listening keys will be carefully adjusted when interviews have ceased.

## Telephone News from the Northwest.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

The Wisconsin Telephone company is putting in a metallic line between Ashland, Bayfield and Washburn.

The Creston, Ia., council has passed an ordinance reducing telephone rates, which are now $5 and $3, to $3 and $1.50. This is a blow at the Iowa Union Telephone company which operates the exchange there.

A telephone line is being built between Virginia City, via Sheridan, to Twin Bridges, Mont.

The Conway Telephone company of Conway, Ia., has incorporated with $5,000 capital stock.

Cleveland, Minn., people want telephone communication with Le Seuer Center, Minn.

The Merrill Telephone company of Merrill, Wis., has incorporated with $10,000 capital stock.

The Phœnix National Telephone company of Indianapolis, Ind., has secured a telephone franchise at Mason City, Ia.

The Globe Telephone & Construction company will be incorporated at Des Moines, Ia., soon to make telephones and equipments. The instrument is the invention of J. Serdinke, a Hungarian who has been living at San Antonio, Tex.

The Northwest Engineering company of St. Paul has secured 35 subscribers for a telephone system at Fairmont, Minn., and will put in an automatic system and have it in operation in 40 days.

## Capital Stock of the Harrison Telephone Company Reduced.

At a meeting of the directors of the Harrison Telephone company last week it was decided to reduce the capital stock, which is $40,000,000, to $20,000,000. The directors of the company held a three days' session, and devoted most of the time to the consideration of details in connection with exchanges in the course of construction. The company's stock was originally $80,000,000. It was reduced one-half about a year ago. Other matters considered were questions as to the bonds to be taken in part payment for the exchanges building at Erie, Pa., Toledo, O., and Detroit, Mich. The directors will meet again next week, and it is announced that the plan of building a manufactory to turn out instruments may be settled.

## Milwaukee Two-phase Power Plant.

An interesting two-phase, alternating power transmission plant is in process of installation at the works of the Milwaukee Harvester company, of which G. H. Schulte is superintendent. A Ball & Wood engine of 110 horse power will be directly connected to a 75 kilowatt Westinghouse two-phase generator, making 7,200 alternations at 300 revolutions per minute and designed for 400 volts. From a marble switchboard power circuits will supply the current to six two-phase motors, assigned to work as follows: Foundry fan, 30 horse power; mower room, 20 horse power; oil house, 10 horse power; elevator, 7½ horse power; ware-

house, 7½ horse power; harvester room, five horse power. The entire equipment is to be ready for operation by August 15th. Charles G. Armstrong of Chicago, the consulting electrical engineer, prepared the plans and specifications.

## Trolley Cars on Clark Street to Adams.

On Monday evening, at the meeting of the Chicago City Council, the ordinance permitting the Chicago City Railway company to build an overhead trolley line on Clark street, in the down-town district, was amended in some particulars at the suggestion of Mayor Swift, and then readopted. The ordinance, which will now undoubtedly receive the mayor's signature, permits the company to erect the line in Clark street to Adams street, three blocks south of Washington street, which the company wished to be the terminus of the road. The end of the first electric street railway to penetrate the business district of Chicago will be directly in front of the office of the WESTERN ELECTRICIAN.

Mr. Swift secured from the street railway company $25,000 for the city, to be used for street lighting. He also secured $30,000 to be applied toward the construction of a viaduct over the railroad tracks crossing Clark street, near sixteenth street. In his message to the council he told how he had tried to get concessions from the railway company. He said it had been a hard task, but that the corporation officials had shown a willingness to give the city something for street lighting and for the construction of the viaduct, but when he proposed an amendment providing for an underground system in the heart of the city, they had absolutely refused to consider it.

The amended ordinance was adopted by a vote of 56 to 11.

The Chicago City Railway company will begin work on the new line as soon as the ordinance is signed. Center posts and 85 pound rails will be used, and the company will endeavor to make the road a credit to its conspicuous location. Superintendent Bowen says that, in his opinion, not one horse car will be running on the South Side one year from date. At present the company is using about 800 horses, whereas during the World's Fair more than 4,000 were at work carrying passengers on the crosstown lines.

## Northwestern Electrical Association.

The programme for the third semi-annual convention of the Northwestern Electrical association of July 17th, 18th and 19th is now complete. It is as follows:

*Wednesday Morning—9 o'clock.*

Roll call.
Address of president.
Reports of committees.
"Central Station Economies;" by J. S. Stephens.
"Electrical Interference;" by A. V. Abbott.

*Wednesday Afternoon.—2 o'clock.*

Visit Edison plant and Metropolitan power house.

*Thursday Morning—9 o'clock.*

"Boiler Feedwaters; their Treatment;" by W. D. Jameson.
"Electric Street Lighting;" by Geo. Cutter.

*Thursday Afternoon—2 o'clock.*

Visit drainage canal.

*8 o'clock.*

Columbia theater.

*Friday Morning—9 o'clock.*

"1. The Choice of Transformers; 2. The Advantage to be Derived by Testing every Transformer Before Placing It on the Line;" by Prof. D. C. Jackson.
"Boilers and Practical Specifications for Building the Same;" by J. C. McMynn.

*Friday Afternoon—2 o'clock.*

Drive through the parks.

## Atlanta Exposition.

The Department of Electricity of the Atlanta Exposition has received the first shipment of machinery for installation. It consists of the General Electric company's alternator of 250 kilowatts capacity for incandescent, arc lighting and power. The wiring for electric lights, both external and internal, has been begun. Orders have been placed with the General Electric and Westinghouse companies for all the incandescent lamps and fixtures, and with the Safety Insulated Wire & Cable company of New York for the underground cables.

## Race of Automatic Carriages.

The *Chicago Times-Herald* announces that it will give $5,000 in prizes for a race between Chicago and Milwaukee on Saturday, November 2, 1895, open to all types of "horseless carriages." This race is similar to the one recently held in France, where the successful competitor operated a petroleum motor. Vehicles must have three or more wheels and be self-contained as to power. Muscular exertion cannot be used to increase the speed of the vehicle, which must carry at least two persons the entire distance. Competing vehicles which derive their power from petroleum, gasoline, electricity or steam will be permitted to replenish or recharge at Waukegan, Ill., and at Kenosha, Wis., but at no other points. Entries must be made not later than September 15th. The prizes are $2,000, $1,500, $1,000 and $500. Competition is open to all comers, but the conditions are such that either the first or second prize must go to an American.

## Electrical Aid in Newspaper Making.

Within a year or two there will be important changes in the mode and means of newspaper making, says the *Chicago Times-Herald*. The reporter will send both description and picture by telautograph; and the reporter of the future is going to draw as well as to write. The editor, whether in his office or temporarily residing at a distant point, will telautograph his orders and ideas, and, by an improvement now being perfected, he will receive telautographic proofs in return. Writers on newspapers will become users of a machine in process of construction by which the present typewriter keyboard will not only set their ideas into print, but will also instantaneously put them into type, eliminating the machine typesetter, as the machine itself has eliminated the hand-compositor, and as the steam press eliminated the hand-press. These are only a few of the changes in the near future of journalism. These and others bound to come will not injure any one, but will divert to other profitable fields labor now occupied intermediately between the writer and the press. By cheapening the cost of producing a newspaper, these changes will improve the business and make it more beneficial to mankind.

# CORRESPONDENCE.

## New York Notes.

NEW YORK, July 13.—There has been some complaint recently against the illegal stringing of wires in the neighborhood of Wall street, across streets and buildings, for stockbrokers' use. Speaking of this practice, a member of the Board of Electrical Control said: "Our inspectors have found wires in the Wall street district as fine almost as the hairs in one's head, insulated with green thread, so that it was almost impossible to see them, and so cleverly run into dark corners that they were traced with the utmost difficulty. They have been run between brokers' offices and poolrooms and used for purposes that we would not permit, even if the wires were put into the subways."

Electric lighting at Newport comes too high, even for the Vanderbilts, it seems. It is reported to have been Cornelius Vanderbilt's intention to use electricity in lighting his new mansion, the "Breakers," but when the Newport Illuminating company asked, it is alleged, $2,000 for laying a cable from its power house to the Vanderbilt residence, Mr. Vanderbilt offered what he considered a fair price, which was refused. He then gave orders to have the gas lighting arrangements completed.

The Edison Electric Light company of Brooklyn, which recently purchased the entire capital stock of the Citizens' Electric Light company of that city, has taken possession of its new property and elected the following board of directors: R. C. Peabody, W. S. Barstow, F. H. Field, A. N. Nielsen and W. W. Freeman. It is likely that Royal C. Peabody will be chosen president. It is the intention of the Edison company to use the Citizens' plant and its wires, which are strung on poles, for supplying the outlying districts with electric light, while the customers of the Citizens' company, in the districts where the Edison has subways, will be connected with the wires of the latter company and supplied with its current.

The latest proposed electric line in Westchester county will run from Mount Vernon along the old turnpike road to White Plains. Surveys have been made, and representatives of the new road are now busy securing permits from property owners. It has not been decided definitely what the name of the corporation shall be. At present the rights and franchises are being sought by the North Mount Vernon Railroad company, which owns and operates a horse car line from the New York, New Haven and Hartford station in Mount Vernon over the White Plains turnpike to a point near Corcoran Manor. This line will form a part of the proposed electric railway. It was in financial straits recently and was bought in by the capitalists who are behind the trolley venture.

The *Sun* is responsible for this story: During a recent heavy shower lightning played a queer prank on Peter F. Sexton, at the Hotel Minot, Eighth avenue and One Hundred and Twenty-sixth street. Sexton, who works in the hotel, was sitting talking with a friend at an open window on the second floor. In the heaviest part of the storm there came a blinding flash. Sexton simultaneously jumped to his feet, giving a yell, and clutching at his trousers in the region of his left-hand pocket. Flame seemed to burst from the pocket, and as the alarmed man tore away part of that side of his trousers, the contents of the pocket fell to the floor. They were four cents, a door key, a knife, and a box of safety matches. Sexton's friend picked up the knife, but found it so hot that his fingers were burned. The key was charred as though it had been in a fire, and the leather to which it was fastened was scorched. Each of the cents burned a circular spot on the carpet where they fell. The matchbox was charred all along one side, but not a match was fired. There were two slight burns on the man's left leg, but neither was serious enough to raise a blister. The trousers were badly scorched. Sexton says that he felt only a slight shock, and thought at first that the matches in his pocket had in some way been ignited. W F. O.

## New England News.

BOSTON, July 13.—Among the systems of rapid transit abroad that attracted the attention of Chief Engineer Howard S. Carson of the Boston Transit Commission was a suspended railway invented by M. Langen. A trial line has been erected and is in operation in Dentz, across the Rhine from Cologne. The cars are suspended and are operated by electricity. It is claimed by the inventor that in this form of aerial traveling derailment is out of the question. This system has been designed for Berlin, and Mr. Carson said that if he remembered correctly a commission had recommended the system for the city of Hamburg. A speed of 186 miles an hour, it is asserted, may be attained by this system, which, if correct, beats the record for rapid transit. Boston people, however, would hardly desire to travel through the air at this lightning-like rate of speed. The suspended car is operated by an electric motor, derailment being prevented by friction plates. The wheels are secured to the motor, and the car is fastened to the motor by means of a center pin. Springs make the car easy to ride in, each truck having four wheels, and each car being supplied with two motors. Brakes are also provided, which grasp the rail both at the top and bottom. The system, it is claimed, is not so expensive as the usual aerial constructions designed for like purposes. The cars move along very smoothly, almost noiselessly, in fact, if the admirers of the system tell the truth about it. The girders which support the cars are built on the cantilever plan, secured to iron columns of various designs, suiting the fancy of the most fastidious. About 50 persons can be carried in a car, which is reached by an elevated station. The supply of electricity is so regulated that if one car gets stalled the car following it is not supplied with any more motive power until the stalled car is started on its journey again, thus reducing the possibility of collision. The brakes work automatically. The cities of Elberfield and Barmen are going to try the system, the contract having already been signed for the building of the road.

The Plymouth (N. H.) & Compton Telephone Exchange company has declared an annual dividend of 6 per cent. and elected the following directors: D. B. Keniston, George H. Adams, Plummer Fox, Moodey Dole and H. I. Lee. They have purchased the property of the Franconia Telephone company, including a service of 25 miles through the famous Franconia Notch. This will give through telephone service up the Pemigewasset Valley through the Notch to the mountains beyond, which has long been needed.

The subscribers of the West Roxbury & Roslindale Electric Street Railroad company have organized and elected these officers: President, Clifford Devens; clerk and treasurer, William P. Whittemore; directors, Thomas H. Dunham, Jr.; Charles G. Davis, Joseph Halstrick, William P. Whittemore, Clifford Devens, Charles H. Wise and George J. Morse.

J. E. Sewell, division superintendent of the Chelsea division of the Lynn & Boston railroad, has resigned to assume the general management of the Waterbury Traction company.

The earnings of the West End Street Railway company upon Decoration Day were by far the largest ever recorded and aggregated $29,000. No previous day exceeding $25,000 is remembered. G.

## Milwaukee, Wis.

MILWAUKEE, July 13.—The pilots and assistants employed on the electric launches on the Milwaukee river struck for higher wages recently. They claimed that they got only $1.25 a day for very long days; that they received no extra pay for overtime and were laid off without pay on rainy days. Manager Rau discharged all the strikers and put new men in their places as soon as possible.

A. J. Shaw, formerly of Milwaukee, more recently of Muskegon, Mich., died recently. He was the inventor of the electric traveling crane. While he was in the employment of the E. P. Allis conpany of this city some years ago a large steam traveling crane broke down and he was directed to design a new one. The electric crane was the result. Shortly afterward Mr. Shaw retired from the Allis company's service and established himself in business. Later he removed to Muskegon, where the Shaw Electric Crane company

built a large factory. Mr. Shaw was president of the company.

Men employed in laying tracks for the State Fair Park and North Greenfield extension of the Milwaukee street railway struck a few days ago. They were getting $1.50 a day, 25 cents more than the ordinary laborer, and they demanded free transportation to and from their work and other concessions. The number that struck was about 100. The management refused to grant them the concessions and several of the subordinate officers of the company were sworn in to protect its property. The men soon regretted their action, and some of them were taken back to work, but the ringleaders were told that their services would not be wanted any longer.

Ever since the idea of building a manufacturing town where South Milwaukee is now located was first conceived, real estate men have planned to build an electric street railway from Bay View to that place, and last year the officials of the South Milwaukee company thought the time had come for such a movement. Owing to the hard times, however, nothing was done during the summer of 1894. About six months ago William M. Williams of Bay View began to interest Milwaukee capital in the project, with the result that a month ago the supervisors of the town of Lake were asked to grant a franchise to the company which has recently been incorporated as the South Milwaukee & Cudahy Street Railway company. The town was to give a bonus to the road, and owing to this condition many meetings were held without any result beyond the promise of a franchise if the company would give $5,000 bonds that the road would be in operation within a year and a half and the condition that at least 50 per cent. of the capital stock be paid in. The company was willing to fulfill these conditions when the town board guaranteed the payment of the bonus. When the South Milwaukee & Cudahy company's plans became public, those who had first suggested the plan afterward adopted by the company made an application to the South Milwaukee village board for a franchise for street cars in that village, but the application has not yet been formally acted upon, though the village is not averse to giving a franchise to any company that actually intends to build. An association composed of real estate men interested in Cudahy property has also taken a leading part in securing the proposed road. The association has corresponded with a number of possible builders and has even asked the South Milwaukee & Cudahy Street Car company to turn over its application to the board of the town of Lake to the association, as some of the members think another plan more feasible. Patrick Cudahy has desired the erection of a line distinct from the Milwaukee Street Railway company from Cudahy to the business district of Milwaukee, with the object of persuading workmen in the city to build suburban homes. The Cudahy Advancement association is anxious to secure a road, and if nothing better can be secured will cooperate with either of the other companies, whose plans greatly resemble each other both as to the route and the manner of operating the line in conjunction with the Milwaukee Street Railway company. At present it seems that four different parties are in the field trying to get the franchise. Congressman McGann of Chicago is said to be willing to build the line if a franchise clear through the city of Milwaukee, one line on the east side and the other on the west side, these to be the nucleus of a complete system, can be secured. It is understood that he is willing to make a four cent rate. This would mean the end of the monopoly now enjoyed by the Milwaukee Street Railway company. The Cudahy Advancement association is inclined to favor Mr. McGann and his proposition. The four cent fare will be a strong argument with the public and it is not impossible that the Milwaukee Street Railway company will experience considerable trouble in the near future. At any rate the Milwaukee company, which a short time ago had no idea of building to Cudahy and South Milwaukee for several years, is now reported to be taking active steps in the matter. Receiver Henry C. Payne will go to New York in a few days to lay the project before his associates. H. C. C.

## PERSONAL.

James Partridge, general manager of the Partridge Carbon company of Sandusky, O., was in Chicago last week.

S. H. Goddard of the *Electrical Review* of New York is in Chicago to attend the convention of the Northwestern Electrical association.

Joseph B. Stearns, inventor of the duplex system of telegraphy, and at one time president of the Franklin Telegraph company, died at Camden, Me., recently.

The University of Wisconsin has conferred the honorary degree of LL. D. upon two men of national reputation on account of their great services in the interest of engineering and the industries. The first of these is Edwin R. Reynolds of Milwaukee, designer and builder of the Reynolds-Corliss engine. The degree was conferred upon Mr. Reynolds in recognition of his position as an expert of the high- and on account of his great ability and success as a designer and inventor. The other recipient of this honor is Don J. W[illegible]

## NEW INCORPORATIONS.

Reed City Electric company, West Reed City, Ill.; capital stock, $10,000; Chas. A. Kimmel, Reed City, Ill.

Oregon Electric Light & Power company, Oregon, Ill.; capital stock, $50,000; to generate and sell electric light and power; Albert H. Knodle, Oregon, Ill.

Metropolitan Gas & Electric Light company, San Jose, Cal.; capital stock, $500,000; to do a general illuminating business; J. V. McKiernan, San Jose, Cal.

Pocatello Electric Light & Power company, Chicago, Ill.; capital stock $150,000; to operate an electric light plant and telephones; Charles W. Spalding, Chicago.

## ELECTRIC LIGHTING.

The Chattanooga Tenn., Light & Power company will build a new plant in the center of the city at a cost of about $50,000. The General Electric company practically owns the plant. There will be no needless delay in commencing work on the new plant. Artesian wells will furnish the water supply. New compound condensing engines will be put in, with the latest improved electrical machinery. The plant will be greatly enlarged.

On a capital stock of $645,000 the Ottawa, Ont., Electric company reports the revenue from all sources for the year ended April 30, 1895, as $152,018.74, and the total expenditure $86,283.42, leaving a net revenue for the year of $65,735.32, being earnings of over 10 per cent. on the paid-up capital stock of the company. The directors, while recommending the payment of a dividend of 8 per cent. for the year, inform the stockholders that after paying two dividends of 4 per cent. each, on December 1st and June 10th, there will still be at the credit of rest account $48,820.12 and at credit of profit and loss account $14,135.32, a total of $62,955.44 after writing off for bad and doubtful debts $3,654.52. The total installations of incandescent lights on April 30th last were 48,797, an increase over the previous year (of the Chaudiere and Standard companies combined) of 6,645 lights; the total increase of arc lights during the year was 28, and there are at present installed 81 motors, an increase of 13 for the year, representing 229 horse power in actual use. For a city of 50,000 inhabitants the showing is excellent.

## ELECTRIC RAILWAYS.

Detroit and Mt. Clemens, Mich., are to be connected by an electric railway.

The North State street line in Chicago is now operated by electric power, horses having been done away with. The road extends from Lake street to Division street and thence west to Clark. Cars are operated at intervals of four minutes.

Mayor Pingree, who has for several years contended for three cent street car fares, witnessed the first practical success of his fight on July 8th, when he acted as motorman on the first car run over the new lines of the Detroit railway. The mayor was cheered enthusiastically along the entire route.

Sweetzer & Smith of Marion, Ind., have been granted a franchise by the Grant county commissioners to construct an electric railway through that county to connect with the electric road being built in Howard county, taking in the towns of Roseburg, Swayzee, Herbst, Sycamore, Greentown and other villages.

The introduction of the trolley on the Philadelphia street railway lines has been a source of inconvenience and expense to the bureau of fire, necessitating the reduction in size of all the wheels on the engines and trucks in the bureau. The trouble has been caused by the new style of heavy rails that are made necessary by the use of electricity. The old flat rails were six inches in width, while these are but four, and the gauge of the track is narrower. The trouble was obviated by taking all the wheels off and bringing them to the repair shops. They were put on a lathe and a half inch taken off on either side. This was done on 46 engines.

Concerning the mooted change of motive power on the suburban tracks of the Illinois Central at Chicago, John Dunn, assistant to President Fish, says: "It is true the officers of the Illinois Central are seriously considering a change to the electric system on the suburban tracks, but I am almost positive no definite arrangements have yet been made. Of course I am not an operating man and the matter might progress further than I think without my hearing of it, but it is not likely. You are safe in saying, however, we would like to adopt electricity, and have been making extensive inquiries with this intention. From Van Buren street south it would be a comparatively easy matter to rig up a trolley system on the tracks used exclusively for suburban service, so it would not interfere with the regular through express trains."

## TELEGRAPH.

A very desirable innovation has been inaugurated by the Philadelphia superintendent of the Western Union Telegraph company in its Germantown branch office on West Chelten avenue, by equipping the messenger boys located there with up-to-date bicycles, to be used in the service. The market price of the wheels is $50 each, but the machines are being sold to the lads at $39 each, to be paid [illegible] for their wheels a new plan has been introduced whereby they may secure more money daily. Heretofore each message was given [illegible] cents for each message he delivers, which will bring him in more money, as the boys say they average from 12 to 25 messages a day.

It is calculated that typewriters have increased the capacity of busy press wires from 30 to 50 per cent. and that in the case of ordinary commercial dispatches the gain has been at least 10 per cent. An instance is given by the Chicago superintendent of one of the telegraph companies where one man received on a typewriter nearly 26,000 words of election news from the East in one night. This was an extraordinary feat, says the *Chicago Record*, but it shows what can be done when it is known that the best work of the expert penman was never above 15,000 words for the same time, and rarely more than 12,000 words. Such a speed for one night frequently paralyzed the arm or hand of the most experienced of operators, and stories are told, when, after a night's siege of that kind, the telegraph receivers would be unable, because of lame arms, to lock the doors. Typewriters score yet another triumph in telegraph offices in the matter of manifolding messages. By the old method of the stylus pen 30 copies of press matter was the limit, and the operator had to press very heavily on the pen to obtain that number. With the machine 30 copies can be duplicated with ease, and even 60 at times.

## TRADE NEWS.

Kohler Bros. of Chicago have sold to C. E. Loss & Co., for the Sheboygan, Wis., Light, Power & Railway company, six double 30 horse power car equipments and a 200 horse power generator, all of the Walker make.

Business with the Metropolitan Electric company, 186-188 Fifth avenue, Chicago, in the fan motor line is better than ever before. The Metropolitan incandescent lamp is giving excellent satisfaction, and the company is making large sales constantly.

The new shops of the Louisville, New Albany & Chicago Railroad company at Lafayette, Ind., will be equipped with a 60 kilowatt Thompson-Ryan power generator to supply current for lights and for transfer table motors. The sale was made by the William Sharp company of Chicago.

Bowers Brothers, Chicago, have found it necessary to move into larger quarters, owing to the great increase in business which it has been their good fortune to meet. They are now located at 117 and 119 Lake street, where they have ample facilities for filling all orders promptly. Bowers Brothers are well known mica dealers who can furnish segments in any shape.

The Cutler-Hammer Manufacturing company of Chicago says that its automatic motor-starting rheostats are as essential for a motor as a safety valve for a steam boiler. This automatic rheostat is designed as a protection to the armature, and the company contends that "one burned-out armature will cause an outlay ten times greater than the price of our automatic protection, in addition to the inconvenience suffered while repairs are being made."

The Louisville Electrical Works of Louisville, Ky., report that they are experiencing a most gratifying demand for their Phoenix transformers, recently placed upon the market, and in order to promptly care for their rapidly increasing orders they have found it necessary to largely increase their manufacturing facilities. They have established the following agencies for the sale of their excellent apparatus: J. A. Machado, No. 203 Broadway, New York; Vallee Bros. & Co., No. 617 Arch street, Philadelphia; W. T. M. Mottram, Dallas, Texas; Russell & Officer Electrical Construction company, Denver.

The Sunbeam Incandescent Lamp company of Chicago has recently made a new discovery in the manufacture of its filament, which enables it to furnish lamps from 5 per cent. to 10 per cent. more efficient than formerly, and with the same life and maintenance of candle power. It is supplying to some large continuous current central stations a 110 volt 16 candle power lamp, consuming but 45 watts, and a suitable lamp for alternating stations, taking but 50 watts. Although it has been but a few months since the factory of the Sunbeam company was again started after having been closed on account of the injunction obtained by the Edison company, it is now running a full force and its business each month has shown a handsome increase. While prices have been greatly reduced, the claim is made for the Sunbeam lamp that it is manufactured and tested with the same care, and in every respect is not only equal to but superior to the lamps which had become so well known and had such an excellent reputation two years ago, when the factory was closed.

An important consolidation in the electrical trade took place last week, when the Brooklyn Electric Manufacturing company and the Sola Arc Lamp company of New York city filed papers completing the transfer to, and getting a charter for, the Sola Electric company, which will be the name of the new concern. The officers elected for this new company are Hewitt Boice, president; Andrew R. Baird, vice-president; Geo. A. Muller, secretary; St. Louis Wintner, general manager, and Samuel O'Connor, treasurer. This new company brings in some men well known about New York in other lines of business. Mr. Boice has been at the head of the Blue Stone association and is identified with many of the railway and banking interests of New York. Mr. Baird has been connected with many business institutions of Brooklyn. Senator Rice is extensively interested in the shipping interests in New York, and Mr. O'Connor is a well-known contractor. The Sola Electric company is located at 65 and 67 Duane street, New York, where it has offices and show-room accommodations, with a shop occupying the rear building on Pearl street. It is installing a large amount of new machinery and is placing

itself in condition to do an extensive business, and with Messrs. Wintner and Muller to care for its business interests, it would seem that there would be no question of the success of this concern.

## BUSINESS.

The Abendroth & Root Manufacturing company, maker of the Root improved water-tube boiler, recently received a cable order for three 113 horse power Root boilers, to be shipped to Johannesburg, South Africa. Export trade is looking up with this company.

Stanley Green, western manager of the Fuel Economizer company, Matteawan, N. Y., has just sold to the Tuttle Manufacturing & Supply company, Anaconda, Montana, 2,500 horse power of economizers. W. G. Gailler, assistant to Mr. Green, closed the deal in Montana last week.

The Western Electric Heating company of St. Paul, Minn., with Chicago office at 1634 Monadnock Block, supplies all kinds of electric heating and cooking utensils. A recent catalogue describes polishing irons, cooking appliances, coffee pots, ranges, curling iron heaters, glue pots, radiators and rheostats.

The Electric Appliance company is securing some very pleasing results from the Upton arc lamps, which have received a number of flattering compliments. The direct and alternating constant current lamps appear to meet every requirement, and the regular series arc lamp is apparently filling the demand for a first-class series arc lamp at a low price.

The Bigelow Electrical Supply company, electrical engineer, contractor and dealer in general electrical supplies at Lincoln, Neb., has been awarded the contract for putting in the electric light plant for the city of Fremont, Neb. The company will proceed with the work at once and have the plant operating before October 1st. It will put in two 50 light 1,200 candle power arc dynamos and one 1,000 light alternator, with tandem compound Corliss engine.

The Grand Crossing Tack company of Chicago has just completed its large wire nail mill and is now moving into it, the wire nail machines which the company has heretofore operated in the tack factory, and also putting into position in this mill the wire nail machinery which was purchased last spring from the receivers of the McCash plant at Burlington, Ia. The mill, as soon as in complete operation, will have a capacity of 1,200 kegs of wire nails per day.

The Erie City Iron Works, 30–34 West Monroe street, Chicago, have lately installed a number of their engines in electric lighting plants, and have been doing a handsome business. Among the more recent orders which this company has received may be mentioned a 50 horse power center crank automatic engine, with tubular boiler, which will be installed in Buffalo, N. Y., and a 100 horse power engine and boiler to be placed in Fowler, Ind.

Julius Andrae & Sons company, Milwaukee, is wiring and installing a complete 250 incandescent light plant on Steamer No. 3 of the F. & P. M. Ry. The company is also wiring the new residence of Mr. Wilbur at Waukesha for electric light, gas lighting, electric bells and speaking tubes, and is installing warehouse telephones at St. Paul for a large commercial house, as well as installing a central station plant at Camp Douglas, Wis. Many smaller contracts have been secured, and on the whole the summer season promises to be a profitable one.

W. F. Parish, general sales manager for the Racine Hardware company, Marquette building, Chicago, received an order for a 17 horse power Racine vertical automatic engine at four o'clock Friday afternoon last week for quick shipment. The engine was tested, inspected, crated and shipped from the works at Racine, arriving in Chicago at five o clock Saturday morning and delivered at found ation by 7:30. This substantiates the company's claim for prompt shipments. Mr. Parish announces that the company has now a stock of 300 engines ready for final test and shipment. Business prospects are favorable, and all departments are running over time.

Among the many standard lines of material for which the Central Electric company is agent, the Billings & Spencer commutator bars and overhead materials are being given great prominence and are giving gratifying results. The company has also lately procured the western agency for a new device known as the automatic trolley wire cut-out. This is attached to the hanger, and in case of the wire breaking between any of the spans, the wire which falls to the ground is not charged, as is usually the case, but as soon as the break occurs the current is immediately cut off so that liability of accident is done away with. This device is very simple in construction, and roads are already being equipped with it. One of these devices is on exhibition in the railway department of the Central Electric company, 173 Adams street, Chicago. Although the company is doing an immense business in this department, it has been enabled to make very prompt shipments.

The Viaduct Manufacturing company of Baltimore, Md., is reconstructing its works at Relay House on the Baltimore & Ohio railroad, nine miles from Baltimore, and they will be ready for occupation within a very few months. This extensive company will then have greater facilities than ever before. The complete destruction of the works by fire in June, 1894, now enables the company to rebuild on a much larger scale, and with special reference to the line of goods that it manufactures. It will continue to utilize its magnificent water power. The works will consist of a wood-working establishment, dry house, machine shop, magnetizing department, varnish room, foundry, nickel plating department, etc., under separate roofs, and each will be erected in the most thorough manner possible. The machinery now used by this company is all of the very latest improved pattern, and the facilities for turning out large quantities of goods are greater than heretofore. Since the fire the company has been running quite a large establishment in the city of Baltimore, but, owing to increasing trade, it has been very much hampered for room and adequate facilties. This company, as is well known, makes a specialty of manufacturing magneto bells, telephone instruments of every description, district telegraph boxes and supplies, and fire alarm apparatus. The company has many patents of its own and is always on the lookout for improvements. Sales are not confined to the United States, but goods are shipped to all parts of the world, recent large consignments having been made of telephone apparatus to Venezuela, South America, and the island of Java.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued July 9, 1895.*

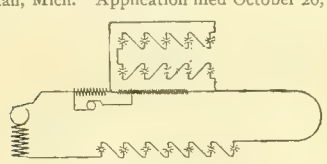
542,228. Trolley Breaker. Henry P. Ball and Charles A. Lieb, New York, N. Y. Application filed August 8, 1894.

The device comprises end metallic pieces to receive the trolley and feed wires, having sockets on their lower inner face, a bar of insulating material sheathed with metal at its ends and detachably secured in the sockets of the end pieces, an intermediate metallic rod detachably secured to the end pieces and insulated therefrom, and a removable top-bar of insulating material carrying a metallic span wire bracket, the end pieces of the insulator being provided with plates and bolts for clamping the feed wires thereto.

542,240. Electric Meter. Frank P. Cox, Lynn, Mass. Application filed February 15, 1895.

The method of operating this electric meter consists in establishing an initial starting torque for overcoming the friction of the moving element of the meter, and gradually diminishing or removing the torque as the load comes on.

542,249. Telephone Switchboard. James F. Gilliland, Adrian, Mich. Application filed October 26, 1894.



NO. 542,240.

The cut shows a telephone switchboard, in which there is the combination with telephone lines terminating at movable plugs at which the lines are normally closed, of a pair of connector plates, insulated from each other, and connected with the calling generator, and other similar pairs of plates, without any circuit connection, such plates being adapted to engage with the plug contacts, so as to open them and connect them with any other circuit connected with the same pair of plates.

542,258. Electrical Measuring Instrument. Frank Holden, Schenectady, N. Y. Application filed January 22, 1895.

A field coil, an index mounted in the axis of the coil, and a yoke of magnetic material carried by the index, the sides of the yoke being parallel to the axis of the coil.

542,279. Arc Light Support. Barton Pickering, Dayton, O. Application filed November 15, 1890.

One claim follows: In combination with the spring-actuated catch, having an inclosing case, the shouldered hanger head to engage said catch, the gravitative dog held in the ears of said catch to hold said head out of engagement with said catch when, by bearing against the face of the same, the same is withdrawn from contact with said hanger.

542,295. Transformer for Alternating Current Systems. Elihu Thomson, Swampscott, Mass. Application filed March 6, 1895.

A transformer for alternating currents is shown, comprising two laminated cores, primary coils wound upon one of the cores, secondary coils upon the other, and plates or links of copper connecting the cores and adjacent to the primary and secondary coils, the plates being connected to earth.

542,309. Electric Brake. William B. Potter, Schenectady, N. Y. Application filed March 20, 1895.

A brake shoe normally engaging with a wheel or moving element when manually actuated, and having then a certain area of engagement, but co-operating with the moving element over a greater area when actuated by power.

542,406. Electric Alarm Gauge. William H. Bradt, Troy, N. Y. Application filed February 23, 1894.

In this device there is the combination with the index, of a cap having a rotary perforated rim, a contact insulated from such rim and fixed thereon to project through the rim aperture into the path of the index, and means for connecting the index and contact with the battery wires.

542,434. Underground Trolley. Leedham Binns, Philadelphia, Pa. Application filed April 11, 1894.

The base plate is formed with integral longitudinal flanges, and a non-conducting rail is fastened in the flanges and covered at its head with a conducting plate.

542,444. Telephonic Transmitter. Charles C. Hughes, Baltimore, Md. Application filed September 12, 1894.

There are an electrode, having a cavity whose sections on planes perpendicular to the direction of motion are arcs of circles of gradually varying radii, and the co-operating electrode having an exterior surface whose sections in the same planes are also arcs of circles of varying radii, the radii of the arcs of normal contact of the electrodes differing in value.

542,459. Electric Battery and Application Thereof to Medicinal Purposes. Seth R. Beckwith, Orange, N. J. Application filed April 3, 1895.

The electric battery consists of a frame open at the sides and a plurality of battery elements composed of metallic plates, in width equal to the thickness of the frame laid lengthwise, so as to be entirely surrounded thereby or locked together and held in position by friction.

542,462. Electric Insulating Material. James O. Brown, Chicago, Ill. Application filed May 5, 1894.

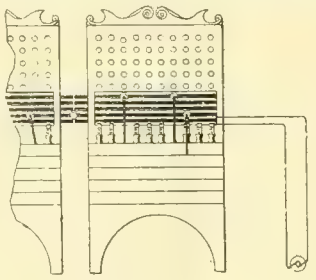
The composition consists of quartz, pyrites of iron and oxide of manganese, made into a vitrified mass.

542,471. Electric Bath Apparatus. William E. Golden, Auburndale, O. Application filed March 5, 1895.

In this apparatus a clockwork mechanism, a winding device therefor, and a registering device in connection with and operated by the winding mechanism are utilized.

542,487. Electric Lighting System and Dynamo Therefor. Morris Moskowitz, Newark, N. J. Application filed May 11, 1895.

This device is a dynamo-electric machine, subject to variable armature speed, having a self-excited field coil in shunt with its armature, an opposing differential high resistance field coil also in shunt with the armature, and a differential series field coil in main circuit, co-acting with the differential high resistance coil to cut down the field magnetism of the dynamo.



NO. 542,249.

542,490. Electric Arc Lamp. Samuel E. Nutting, Oak Park, Ill. Application filed September 8, 1894.

A short-circuiting device is placed between fixed cross heads connected by a thermo-electric conductor, and is adapted to automatically close and relieve the conductor of excessive current.

542,505. Arc Lamp. Albert C. Seibold, Mount Vernon, N. Y. Application filed January 7, 1895.

A closed globe and an internal foraminous guard surround the arc and extending throughout the length of the globe.

542,508. Medical Electrode. Andrew P. Van Tuyl, Jr., Brooklyn, N. Y. Application filed May 15, 1895.

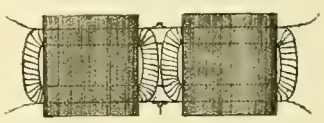
An electrode for medical electro-therapeutic use, having a sponge plate to which the conductor is connected, and the corners of which plate are turned over to form hooks, and the removable felt or sponge secured by the hooks.

542,512. Electric Railway System. Robert B. Wilson, Cincinnati, O. Application filed January 2, 1894.

A trolley for underground electric railways is described, consisting of two vertical supports connected to the respective brushes of an electric motor, arms pivotally connected with the supports and provided with coil springs, wheels mounted on the arms, and pins whereby the upward movement of the arms is limited.

542,543. Electrically Controlled Motor. George L. Thomas, Brooklyn, N. Y. Application filed April 25, 1895.

An electro-magnet is utilized to move a rocking lever for opening the valves.



NO. 542,295.

542,550. Railway Block Signal System. George M. Brown, Galesburg, Ill. Application filed May 4, 1895.

This arrangement comprises a source of electricity for every block, two traffic rails, the one continuous and the other broken into sections insulated from each other; two conducting rails, the one continuous throughout the entire block and the other broken into a plurality of sections insulated from each other, an electro-magnet connecting the two adjacent ends of the broken traffic rail, and a circuit-breaker operated by the magnets and connecting the insulated sections of the broken conducting rail, and signals carried by the cab and operated by the conducting rails.

542,589. Electric Arc Lamp. Frank M. Hildebrandt, Edwin S. Hildebrandt and Henry F. Hildebrandt, Baltimore, Md. Application filed December 27, 1893.

Claim 1 reads: An arc lamp, having the electrodes around the arc inclosed in a small transparent or translucent normally air-tight casing, said casing being provided in its upper end with a valve or valves normally closed, whereby the casing is filled with a highly luminous gas and the longevity of the electrodes is extended.

542,591. Trolley Finder. Charles C. Lynde, Buffalo, N. Y. Application filed November 28, 1894.

This is a trolley guide, consisting of a frame centrally pivoted to the trolley pole, its lower portion having a loop encircling the trolley pole to limit its swinging movement, and its upper swinging portion having a cross-piece adapted for contact with the lower side of the trolley wire.

REISSUES.

11,503. Automatic Electric Weighing Scale. Charles F. Wood, Richmond, Va. Application filed January 29, 1894.

The combination comprises a scale beam, a hopper or receptacle, and a transfer hopper or funnel, electrical devices for controlling the discharge door of the hopper or receptacle, electrical devices for controlling the transfer hopper or funnel, and two circuit closers controlled by the movements of the scale beam and included in an electric circuit with the electrical devices and a generator.

# Western Electrician.

EVERY SATURDAY.

Vol. XVII. CHICAGO, JULY 27, 1895. No. 4


## The Northwestern Electrical Association at Chicago.

The third summer meeting and sixth convention of the Northwestern Electrical association was held in the Leland Hotel, Chicago, on Wednesday, Thursday and Friday of last week. About 160 visitors were in attendance, and the gathering was one of the most successful thus far held by this young and vigorous organization, despite the fact that the recent death of H. C. Thom, the president elected in Milwaukee last January, cast a tinge of sadness over the proceedings. Vice-president Grimm of Jefferson, Wis., was elected president for the unexpired term, and he proved worthy successor of Mr. Thom.

Six papers were read and discussed in the three sessions of the convention. All the business could have been easily transacted in two days, but, as at previous semi-annual conventions, much time was devoted to relaxation and sight-seeing.

The entertainment features were carried out according to programme and proved very enjoyable. On Wednesday afternoon some fifty of the members and visitors inspected the West Side plants of the Metropolitan elevated electric railway and the Chicago Edison company. These two great installations were viewed with great interest and carefully inspected. M. H. Gerry, Jr., piloted the visitors through the Metropolitan plant, and L. A. Ferguson, Thomas H. Creden and C. G. Y. King did the honors at the Harrison street station. The latter plant, in particular, was highly commended, and a smaller party later inspected the distributing station on Adams street. Many of those in attendance, however, accepted the invitation of W. D. Jameson, and were entertained in the office of the Dearborn Drug & Chemical Works in the Rialto building by General Manager Edgar.

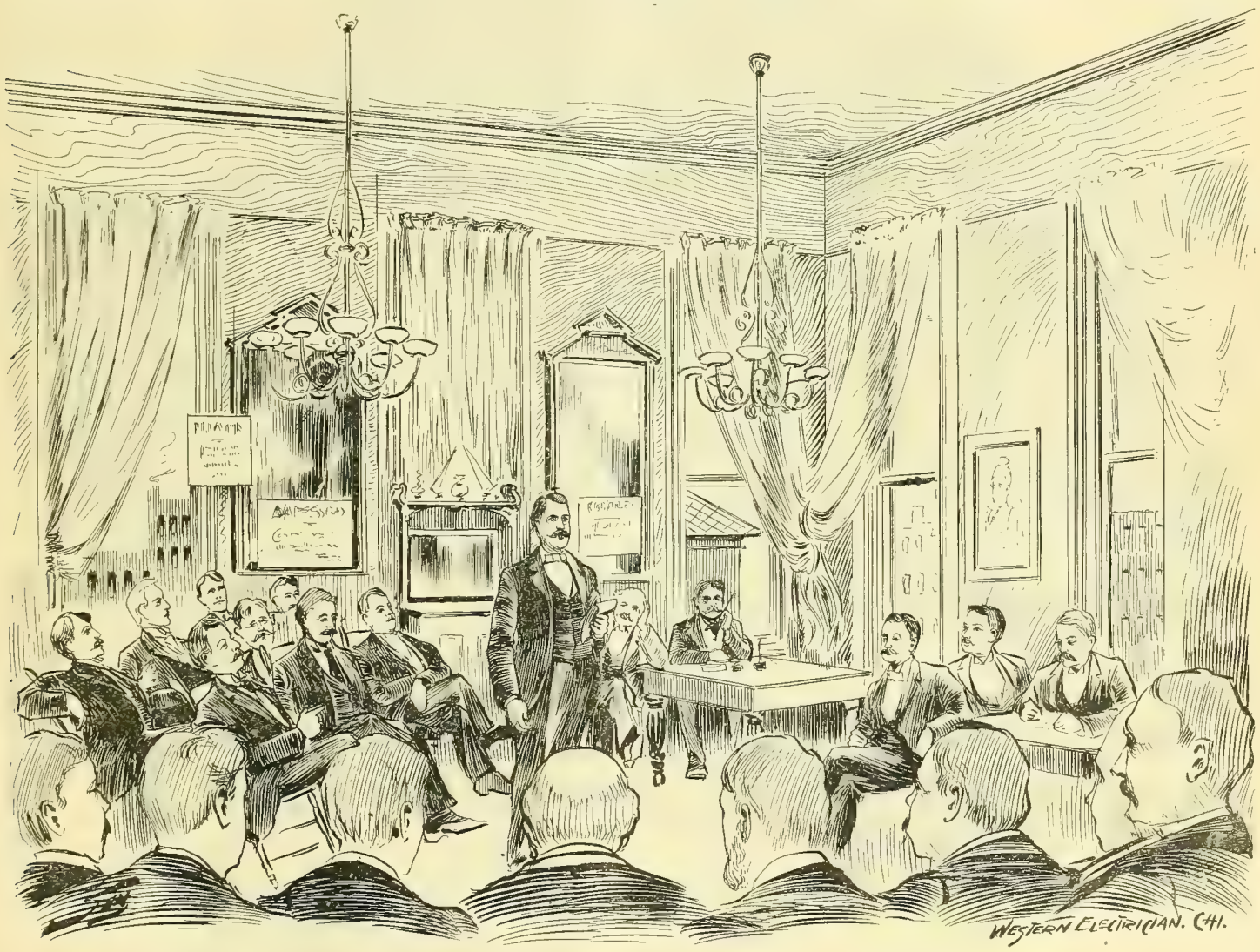
The trip along the drainage canal by special train on the Sante Fe road, on Thursday afternoon, proved a jolly outing. The "boys" took in the points of interest as far as Lemont and had a fine time, with none to molest or make them afraid. At Lemont a considerable stop was made, and here W. J. Ferris of the General Electric company made the excellent group photograph of a portion of the company which is reproduced on page43. In the evening the electrical men were in possession of the Columbia theater, having braved a drenching rain-storm, and witnessed the production of "The Merry World." The actors introduced several convention "hits," as when *Napoleon*, in the burlesque on "Madame Sans Gene," in reproving an obstreperous character, commanded: "Be silent; you make more noise than 'Noisy Bunce.'" Another character, on being reprimanded for smoking on the stage, remarked that it was all right; he had the permission of "Sam" Morse.

On Friday afternoon a drive through the South Side parks and boulevards completed the merry-making. The party had an enjoyable trip and was entertained by S. F. B. Morse, G. E. Bailey and others at the Chicago Beach hotel and the Hyde Park club.

The meetings of the association were held in the hotel ordinary. A view of the coennvtion in session is presente l on this page. The speaker represented is W. D. Jameson, who read a paper on "Boiler Feedwaters."

The exhibits were held in the parlors on the second floor. They represented a wide range of apparatus, as will be seen by the views on page 42.

The next convention will be held in Milwaukee in January, 1896.




THE NORTHWESTERN ELECTRICAL ASSOCIATION IN SESSION AT THE LELAND HOTEL, CHICAGO.

## Siemens & Halske Electric Company of America

The annual meeting of the stockholders of the Siemens & Halske Electric company of America was held at the general offices of the company in the Monadnock building, Chicago, on July 15th. It was decided that the object for which this corporation was formed be enlarged so as to include the manufacture and sale of motors, electric and other locomotives, steam engines and apparatus connected therewith. Thereupon it was decided to increase the number of directors from five to nine, and the following named gentlemen were elected: Arnold von Siemens, Georg Wilhelm von Siemens, O. W. Meysenburg, W. F. Furbeck, A. W. Wright, Martin Maloney, Francis B. Badt, David B. Lyman and Charles E. Yerkes.

It will be noted that one of the old directors, Sir William Van Horne, president of the Canadian Pacific Railway company, is not on the new board. Mr. Van Horne, however, retains all his old financial interest in the company, but, owing to his multiplicity of duties, he declined to serve on the new board. The new directors are: Charles E. Yerkes, W. F. Furbeck and Martin Maloney, who represent the Yerkes interest in the company; David B. Lyman, representing the Grant interests, and F. B.

Badt, who has been actively connected with the Siemens & Halske company for over a year.

Immediately after the stockholders' meeting, a meeting of the new board of directors took place, and the following officers were elected to serve for the ensuing year:

President—Augustine W. Wright.
Vice-president—Charles E. Yerkes.
Secretary—Francis B. Badt.
Treasurer—O. W. Meysenburg.

It was announced that the former president of the company, O. W. Meysenburg, absolutely refused to be re-elected to that position, as he found it would be necessary to give more of his time in the future to other interests. He is president of the Wells & French company, car builders. The company does a large business and expects to do a very large business in the street railway line besides. The former vice-president of the Siemens & Halske company, Augustine W. Wright, is also well known to the readers of the WESTERN ELECTRICIAN. He is a practical railway engineer and is considered an authority on all questions of railroading. He is still interested in many of his former enterprises, covering especially the construction of railways, and is also a partner of Mr. Meysenburg in the Wells & French company. Charles E. Yerkes is the son of Charles T. Yerkes, the well-known street railway magnate. It is understood that Mr. Yerkes will actively engage in the promotion of Siemens & Halske machinery in the East. F. B. Badt has been identified with the progress of electrical engineering in this country since 1881, and the responsible position to which he has been elected may be considered as an acknowledgment of the satisfactory and effective service he has given his company. Mr. Badt is well known to the readers of the WESTERN ELECTRICIAN as a contributor of many valuable articles and as the author of hand-books for dynamo tenders, bell hangers, incandescent wiring and power transmission.

It will be remembered that the capital stock of the Siemen & Halske Electric company was increased to $2,000,000 some time ago, of which $700,000 is preferred stock and $1,300,000 common stock. The Grant Locomotive Works, which were leased after the great fire last year as temporary quarters, have been bought and are now the property of the Siemens & Halske company.

With the new capital and the many new interests, it may be expected that the company will enter into new lines and will be a powerful factor in street railway work especially. With its allied interests, this company will now be able to take complete contracts for electric railways. Without going outside its own companies, it can construct the track, build the power plant, furnish engines and generators and complete electric car equipments, car trucks and car bodies. It may be said that no other company in the United States has similar facilities. Mr. Meysenburg and Mr. Wright, it will be remembered, have been pioneers in the building of cable roads in this country, and are just carrying out a large contract on the drainage canal.

## THE CONVENTION

### Of the Northwestern Electrical Association at Chicago.

On Wednesday morning, July 17th, the third summer gathering of the Northwestern Electrical association was convened in the ordinary of the Leland Hotel, Chicago. Owing to the death of President H. C. Thom, the chair was occupied by the first vice-president, George Grimm, who called the delegates to order. After the roll-call by Secretary Goltz, Vice-President Grimm delivered an introductory address. It is as follows:

MR. GRIMM'S ADDRESS.

Since custom demands that your presiding officer shall present a brief address at the opening of the convention, I will endeavor to perform my duty. Were it not for the sad event which has touched our hearts with deepest sorrow, this duty would to-day devolve upon another; and were it not for the love I bore for my departed friend and the wish to pay tribute to his memory, I would prefer to ask one more competent to the chair.

When memory takes us back to last January, when, by unanimous consent, Henry C. Thom was elected president of this association; when we see his cheerful, ruddy, kindly face beaming with good will and whole-souled manhood, his sturdy form erect as a young oak, and hear his voice so full, firm and pleasing, it becomes hard for us to realize that we shall never see him again. There is that in the character of a truly noble man that casts its hallowing influence upon all those who approach within its circle and irresistibly compels the heart to love and trust. An influence emanates from him that leaves its charm forever potent in the memory; that gladdens while we weep, and enriches our lives, though impoverished by loss.

I knew Mr. Thom for many years. I saw him steadily and resistlessly, by his force of character, win high position, and by his sterling manhood win friend after friend, until few men, if any, could find a warmer or wider welcome in his state. Eulogy in words seems weak and futile to those whose hearts offer a eulogy more tender, more loving, more eloquent than their lips can utter. Those who have looked upon his countenance and heard his voice cannot forget him if they would, and those who did not know him cannot by any description of him, however truthful, form an opinion that would do him justice. He has gone from us; we grieve at our loss, and the world is better for his having lived in it. What more should be said, what better tribute can we pay? Though his years were few, his influence will remain and perform the good work which he could not complete. It is a blessed truth that even the bitterest sorrow for a departed friend is leavened with sweetness; and though the heart may bleed, it turns again and again to recall his memory and its controlling power, until, like an influence from beyond the grave, it slowly melts the most poignant grief and leaves only the sweetness of loving remembrance.

To those who stood so near to him and cherished him as no others can, to the wife of his bosom and his loving children, we extend the sympathy of friendship, and pay him that tribute all strive to merit, but few with success, that the world is better for his having lived in it.

I do not know whether it is incumbent upon me to present any views as to the work this association should undertake in the future or make any recommendations in regard thereto. My knowledge of electrical matters is limited to those things which I have deemed necessary to successfully manage a small plant. If you will permit me I will, however, make a few suggestions that common sense and sound business principles demand should not be ignored by this convention if we wish to promote the purposes of its organization and the welfare of our business.

Your former president, Mr. Paige, in his last annual address, forcibly called attention to the magnitude and importance of the electrical industries of the country, representing an investment of several hundred millions of dollars, and creating results so pre-eminently beneficial to the public

1. Page Belting company. 2. Sioux City Electrical Supply company. 3. Allen Soldering Stick.
4. C. E. Woodruff & Co. 5. Staff of Electric Appliance company.
6. Mason Electric Equipment company. 7. Hayes-Fife company.

CHICAGO CONVENTION OF THE NORTHWESTERN ELECTRICAL ASSOCIATION.—AMONG THE EXHIBITS.

that simple justice demanded an honest consideration from every government, municipality and individual. Instead, Mr. Paige pointed out, there was constantly waged against these and kindred enterprises an infamous and communistic warfare, antagonistic to the true principles of our institutions and government. At the conclusion of the address it was remarked that it presented rich food for reflection. And it does—reflection on our part as well as on the part of the general public. We may take it as an indispensable truth that no evil, no sentiment destructive of or foreign to common fairness, can live and grow under a government based upon and deriving its power from the consent of the governed, without the existence of a like evil to give it nourishment. The very basis of this government is equal justice to one and all, not as an idle phrase printed upon a statute book, but as a principle living in the heart of each individual. If, therefore, we see an evil growing in the community, one that works injustice or injury, we should find the cause that has dulled the sense of justice in the people and permits the evil to exist. In our case the cause should not be hard to find. How many corporations who are enjoying valuable franchises granted to them as gifts by municipalities conduct their business with any other thought or object in view than the profits to be made? They will improve the service or extend their lines if they must, or if they can grain additional patronage; but every move is actuated either by expected gain or public (municipal) compulsion. Complaints of poor service, irregularity, overcharge, and the like are utterly ignored, until recognition is compelled by public sentiment or authority. Competition is kept out, destroyed or made harmless by combinations. Every effort is directed to the earning capacity, frequently for the purpose of forcing, by its dividend-paying qualities, a stock, originally watered, up to par. Every concession requested by the community that gave it the possibility of existence is resisted until the patience of the public is exhausted and sentiment becomes inimical to an industry that should have received united support and commendation.

The sentiment of dislike and clamor for municipal ownership of the quasi-public industries like electric lighting, gas works, water works, and the like, is the natural outgrowth of either unduly large profits extorted by the line of policy above referred to, or by lack on part of the managers of proper regard for the rights of the people. I fail to find any other cause. The root of it all is that some of these corporations seem unable to realize that their business is not strictly private, but semi-public in its character, and should be managed accordingly. While undoubtedly most of these industries are run upon a broad gauge plan, regardful and mindful of the rights and wishes of the public, yet it must be evident to all that there are many that are liable to every charge of the evils complained of. The public never stops to discriminate in passing judgment, and the result is that the general sentiment becomes hostile to all alike, and ready to accept any plan of relief or retaliation which may be suggested, even as against industries which are not at fault and which would innocently suffer. Thus the agitator and pot-house politician find ready soil to receive their seeds of communistic doctrine and willing ears for the abuse of others and self-glorification.

It is to this subject that I invite your consideration both as individuals and as a body. We are dependent upon the public good will; a contest is destructive to our interests. We should use our influence in every possible direction to gain and hold this good will. The business is hazardous at best and we cannot afford to add additional risks, such as public ill will would bring.

This convention promises to be most successful. The programme will be found very interesting; and the entertainment committee seems to have prepared a list of pleasures fully in accord with the famed hospitality of the city of Chicago.

The committee on entertainment reported the programme of entertainment, and then J. S. Stephens' paper on "Central Station Economies" was read and discussed. The reading of A. V. Abbott's paper on "Electrical Interference" followed. The discussion on this paper lasted until adjournment.

THURSDAY'S SESSION.

The association first listened to a short report of the committee on legislation, and then W. D. Jameson read a paper on "Boiler Feedwaters; Their Treatment."

Action was taken to straighten out the financial relations

GEORGE GRIMM, THE NEW PRESIDENT OF THE NORTHWESTERN ELECTRICAL ASSOCIATION.

of the association and the estate of the late president, and then Vice-president Grimm took occasion to thank those firms advertising in the pamphlet report of the proceedings.

George Cutter read his paper on "Electric Street Lighting," and an exhaustive discussion followed.

The death of Mr. Thom having caused a vacancy in the list of officers, an election resulted as follows:

President—George Grimm.
First vice-president—Pliny Norcross.
Second vice-president—P. H. Korst.

William Goltz and John Schuette, as secretary and treasurer, respectively, were, of course, undisturbed by the changes.

DELEGATES TO THE CHICAGO CONVENTION OF THE NORTHWESTERN ELECTRICAL ASSOCIATION INSPECTING THE DRAINAGE CANAL AT LEMONT, ILL.

MISCELLANEOUS BUSINESS.

On motion F. A. Copeland, Pliny Norcross and Irving P. Lord were appointed a committee to draft resolutions on the death of President Thom. A suitable memorial was afterward adopted. Letters from Mrs. Thom, expressive of heartfelt appreciation of the sympathy of the association, were read.

The question of providing an automatic cut-out for transformers was brought up.

W. H. THORP: I am interested in an alternating light station at home, and I think from my experience, and from the registration of the instruments at the station, that there is a considerable current consumed at the transformers, or converters. And I would like to know whether anything has been invented that will automatically cut out the converter when it ceases to be of use, when the family goes to bed, for instance—or if something cannot be invented that will cut the converter off from the mains when the last light is cut off. It would be a boon to central stations if there were such an invention, and if there is one, I would like to know where it can be obtained. If there is not, I make the suggestion that inventors study up some such a plan. There must be some way of getting at it, either directly or indirectly, and if something could be done that would automatically cut them out, I think it would be a saving at the coal pile. I have seen circulars of apparatus by which a person at the station can automatically cut in arc lights on the line, and if they can do that, I cannot see why something could not be made to cut in and out the transformers or converters.

A MEMBER: I presume there are ten thousand men on the road to the insane asylum trying to work it out.

ANOTHER MEMBER: There is a man in Chicago studying a device of that kind. He is now in Washington making application for his patent. It is working in Chicago to-day.

FRIDAY'S SESSION.

Twelve applications for membership were received and favorably acted upon.

John C. McMynn read a paper on "Boilers and Suggestions for Boiler Specifications." An interesting discussion followed.

In the absence of Prof. D. C. Jackson, T. R. Mercein read the paper on transformers prepared by the former. There was little discussion.

Mr. Schuette gave an entertaining talk upon his experience since coming to Chicago.

The president then appointed as an entertainment committee, for the January meeting in Milwaukee, Herman Andrae, O. M. Rau and Walter C. Smith, and as the committee on transportation Thomas R. Mercein, to be assisted by the president and secretary of the association.

A programme committee of five, with Fred De Land as chairman, was appointed. An especial effort will be made to secure valuable papers and studied discussion for the winter convention at Milwaukee.

MUNICIPAL OWNERSHIP.

MR. DE LAND: I hold in my hand a report of the electrician of the city of Chicago, and in view of the interest that is being taken in the establishment of municipal lighting plants, I will read it. [Mr. De Land read the report.] The matter of interest on the amount of capital invested does not appear in the report, nor is there any allowance made for depreciation and taxes, or other items that a commercial company would have to pay. Here is a company operating 1,484 lamps under conditions that would appear to be excellent, and it is costing $96.72 per lamp per year for labor and material alone.

ADJOURNMENT.

President Grimm, stating that there was no further business before the convention, announced that the next convention, at Milwaukee, would be strictly devoted to education and mutual improvement. After passing the usual resolutions of thanks the assodiation adjourned.

## The New President.

Henry C. Thom's successor as president of the Northwestern Electrical association is George Grimm of Jefferson, Wis., who had been first vice-president. Mr. Grimm is president and manager of the Jefferson Electric company, and takes a lively interest in the affairs of the association. He is a practicing lawyer and was born in Jefferson in 1859. He is well known in politics and has been a member of the State Legislature. He organized his central station company in 1893. As an instance of his energy and tact, it is related that three times previously attempts had been made to introduce electric lighting in the city, but each time the effort failed. Mr. Grimm's ability promptly secured the necessary capital and support, and the company has been upon a good paying basis since its organization. Mr. Grimm has all the qualifications of a competent executive.

## Delegates and Visitors.

The following is believed to be a complete list of the names of delegates and visitors at the convention:

Abbott, A. V., Chicago Telephone company ..... Chicago.
Alexander, P. H., Electric Selector & Signal company. New York.
Allen, L. B. ..... Chicago.
Allison, M. H., Sunbeam Incandescent Lamp company .. Chicago.
Arnold, B. J. ..... Chicago.
Austin, M. B., Safety Insulated Wire & Cable company. Chicago.
Baker, C. O., Chicago General Fixture company ..... Chicago.
Ball, W. D., Ball & Allen ..... Chicago.
Bartholomew, Wm. S., Adams & Westlake company .. Chicago.
Beetle, Geo. L., Western Electric company ..... Chicago
Boyer, F. M., General Electric company ..... Chicago.
Brittan, Louis, Washburn & Moen Manufacturing company ..... Waukegan, Ill.
Buckley, W. J., Fort Wayne Electric corporation .. Chicago.
Bunce, A. C., General Electric company ..... Chicago.
Burch, L. W., Metropolitan Electric company ..... Chicago.
Burlingham, C. L., McDermid Manufacturing company .. Chicago.
Burton, Chas. G., Central Electric company ..... Chicago.
Carey, P. H., Phœnix Iron Works company ..... Chicago.
Carney, J. B., WESTERN ELECTRICIAN ..... Chicago.
Church, W. L. ..... Chicago
Church, J. V. S., *Electrical World*. ..... Chicago.
Cole, G. L. ..... Beloit, Wis.
Collins, L. W., Lee & Collins ..... Chicago.
Collins, W. F., WESTERN ELECTRICIAN ..... Chicago.
Collins, Carroll ..... Murfreesboro, Tenn.
Connor, John F. ..... Chicago
Conover, G. W., Perkins Electric Switch Manufacturing company ..... Chicago.
Cooke, J. H., Buckeye Electric company ..... Chicago.
Copeland, F. A., Edison Light company ..... La Crosse, Wis.
Cravath, J. R., *Street Railway Review* ..... Chicago.
Creden, Thos. H., Chicago Edison company ..... Chicago.
Cutter, George ..... Chicago.
Drake, F. E., Standard Electric company ..... Chicago
De Land, Fred, *Electrical Engineering* ..... Chicago.
Donohoe, Francis E., American Electrical Works ..... Chicago.
Edgar, Wm. H., Dearborn Drug & Chemical Works ..... Chicago.

Farwell, Geo A., Waukesha Electric Light company.....
..... Waukesha, Wis.
Ferguson, L. A., Chicago Edison company..... Chicago.
Ferris, W. J., General Electric company..... Chicago.
Fohrich, C. W., WESTERN ELECTRICIAN..... Chicago.
Foster, Geo B..... Chicago.
Frink, M. W., A. W. Harris Oil company..... Chicago.
Fyfe, John C., Hayes-Fyfe company..... Chicago.
Gage, C. S., Washburn & Moen Manufacturing company. Chicago.
Gilie, H. J., General Electric company..... Chicago.
Goddard, S. H., *Electrical Review*..... New York.
Goltz, Wm., Goltz & Sinclair..... Milwaukee, Wis.
Gregory, Chas. E..... Chicago.
Grier, Thos. G., Grier Bros..... Chicago.
Grimm, Geo., Jefferson Electric company..... Jefferson, Wis.
Grover, T. F., Milwaukee & Wauwatosa Electric company.
..... Wauwatosa Wis.
Gunderson, C., Four Lakes Light & Power company. Madison, Wis.
Gutmann, Ludwig..... Chicago.
Hagar, E. M., Southwark Foundry & Machine company. Chicago.
Hall, Eugene..... Burlington, Wis.
Harding, J. H., La Porte Electric Light company. La Porte, Ind.
Hartley, B., Hartley Electrical Works..... Chicago.
Haskins C C..... Chicago.
Hayes, James, Hayes-Fyfe company..... Chicago.
Healy, J. S., American Electric Manufacturing company. Chicago.
Highlands, Edward M., Clinton Gas Light & Coke company..... Clinton, Ia.
Hill, Joseph M., Columbia Incandescent Lamp company and Wagner Electric Manufacturing company..... Chicago.
Hixon, H. R., Simplex Electrical company..... Chicago.
Hood, Wm..... Chicago.
Huey, Arthur S., General Electric company..... Chicago.
Hull, W. S., White Manufacturing company..... Chicago.
Hussey, M..... Waukegan, Ill.
Jameson, Willis D., Dearborn Drug & Chemical Works... Chicago.
Junkersfeld, P., *Electrical World*..... Chicago.
Just, Paul C..... Chicago
Keily, W. E., WESTERN ELECTRICIAN..... Chicago.
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Korst, P. H., Badger Electric company..... Racine, Wis.
Kountz, R. F..... Neillsville, Wis.
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Low, W. W., Electric Appliance company..... Chicago.
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McMynn, John C., R. T. Hunt & Co..... Chicago.
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Nahm, Louis, American Electric Manufacturing company. St Louis.
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ELECTRICALLY OPERATED COLLIERY AT WYOMING, PA.—ELECTRIC DRILL.

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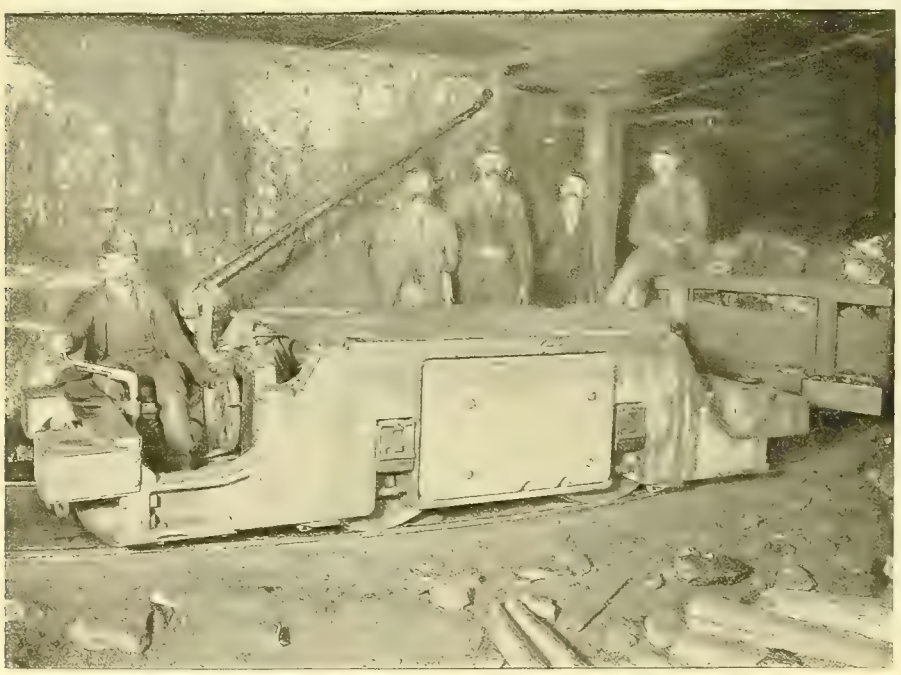
Wiley, J. R., Standard Underground Cable company..... Chicago.
Wiley J. F..... Stevens Point, Wis.
Wilkinson, C. D., Western Electric company..... Chicago.
Willson, R. A., Light & Power commission..... Marquette, Mich.
Wilson, Wm., Electric Appliance company..... Chicago.
Wilson, Chas. E., Fort Wayne Electric corporation..... Chicago
Wolff, James, New York Insulated Wire company..... Chicago.
Woodruff, H. O., Sioux City Electrical Supply company.
..... Sioux City, Ia.

## Electrically Operated Colliery at Wyoming, Pa.

An excellent example of coal mine operation is the electrical installation at the Mount Lookout colliery at Wyoming, Pa., where locomotives, pumps and drills are being successfully and economically operated by electricity. This plant was installed by the General Electric company and all the electrical apparatus employed is of its manufacture. The source of power is a McEwen high speed engine making 218 revolutions per minute. It is located in the power house—a brick building 200 feet from the main shaft, and about 100 feet from the air shaft. Belted to this engine are two multipolar General Electric generators, one of 100 kilowatts capacity, the other of 20 kilowatts capacity. Haulage, drilling and pumping in the mine are accomplished by employing current from the larger generator, while that from the smaller is taken for the incandescent and arc lighting circuits on the surface. In case of accident to the larger generator, the current from the smaller one can be utilized for power purposes.



ELECTRICALLY OPERATED COLLIERY AT WYOMING, PA.—ELECTRIC LOCOMOTIVE.

From the two skeleton switchboards in the power house the circuits are led, one to the surface the other to the mine. The office, engine and boiler houses are lighted by incandescent lamps; the breaker and surrounding grounds by 2,000 candle power arc lamps.

The conductors for the mine operations are strung 300 feet down to the bottom of the air shaft and consist of lead covered cables for the feeders and returns. The feeders are carried along the main gangways parallel to the trolley wire, or through old workings or airways. The feeders are waterproof rubber-covered copper wires strung on glass insulators attached to roof blocks.

At the bottom of the shaft the feeders divide, one branch supplying current to the north workings, the other to the south workings. No. 0 hard drawn wire is used for the trolley wire, the rails being bonded for the return. The trolley is suspended from oak roof blocks by a special mining ear which clamps the wire but is not soldered to it.

Haulage in the north workings is effected by one electric locomotive which weighs about 6½ tons, equipped with two single reduction waterproof motors. It has a drawbar pull of 1,500 pounds on the level at six miles an hour, while at starting it will exert a pull of 3,500 or 4,000 pounds without slipping the wheels. The extreme dimensions of this locomotive are 11 feet four inches long, 57 inches wide and 34 inches high. The total length of the gangway over which it operates is about 2,800 feet, although, including sidings, and turnouts about 3,000 feet of trolley wire is suspended in the north workings. The locomotive makes between 20 and 25 round trips per day. It is hauling at present seven loaded cars, but is capable of easily handling twice this number. The grades vary from the level to 2.8 per cent. and all are against the empties.

Haulage in the south workings is effected by a locomotive equipped with two single reduction motors, and having a drawbar pull of 2,500 pounds on the straight level at a speed of six miles an hour. At starting, however, it can exert a drawbar pull of 4,000 to 5,000 pounds without slipping the wheels. The total weight of the machine is about 10½ tons. It is 11 feet four inches long, 58 inches wide over all and 34 inches high. The maximum run made by this locomotive is about 1,200 feet, and the length of the wire used, including turnouts and sidings, is about 1,800 feet. At present this machine is hauling 10 cars and making from 40 to 45 round trips, pushing in the empties and hauling out the loaded cars. In starting from the entries *F*, *G*, *H* and *I*, shown on the map, where the trips are made up, the locomotive does its hardest work, as there is a sharp grade and curve against the loaded cars. Each mine car empty weighs 3,000 pounds, and loaded 8,000 pounds.

The south workings haulage line is to be extended from *H* to *K* and through a rock tunnel at *L*. The branches *F*, *G* and *I* will then be abandoned and the locomotive will then operate over about 3,500 feet, hauling 400 cars per day from the head of the rock tunnel at *L*.

The electric pump is situated in the workings off the branch *I*. It is a standard duplex double-acting piston Knowles pump operated by a General Electric motor, and has a capacity of 300 gallons of water against a 40 foot head. The piston speed is constant and should the water fall below the mouth of the suction pipe, the pump does not race. This pump has been in operation for more than a year, working 23 hours a day. It requires no attention, except at starting and stopping, and an occasional oiling.

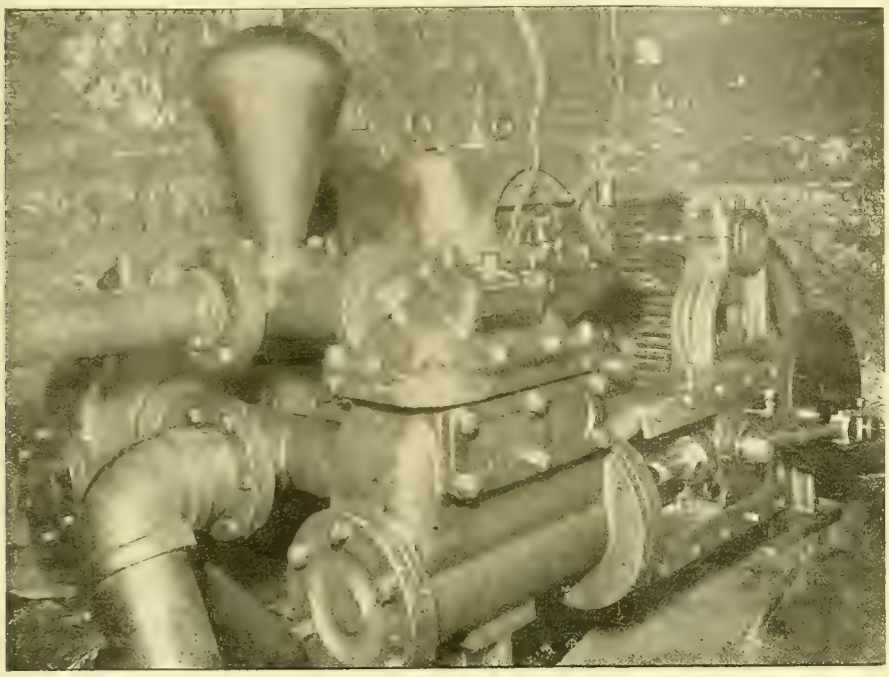
Two General Electric rotary coal drills are also in a low seam in the southeast workings of the mine. These are run from a circuit taken from that connected with the feeders in the main gangway. The length of this is about 1,400 feet. The drills are working a three-foot seam of coal and taking up a two-foot slate bottom. They make about six feet per minute, with an inch and a half bit in the coal and four feet per minute in slate or "boney."

Since this electric plant was started it has operated without hitch or accident. Its installation has induced a decided economy in the operation of the mine, and is exciting considerable interest among coal operators, to whom it stands as an object lesson in the economical operation of mines.

## Telephone System for the Metropolitan Elevated Road, Chicago.

The telegraph has been recognized as an almost indispensable feature of every great railway system, but there are times when it is very unsatisfactory. It can readily be seen that the telephone possesses many admirable features as an auxiliary in the system for controlling the movement of trains and for other purposes. The management of the Metropoli-

tan Elevated Electric Railway Company of Chicago recognized the necessity of introducing a telephone system in this plant, and as a result the Western Telephone Construction Company has been awarded a contract for installing thirty instruments at once, connecting all the stations now in use with the main offices. H. M. Brinkerhoff, electrical engineer for the West Side Construction company, reported favorably upon the system, and it was accordingly adopted.



ELECTRICALLY OPERATED COLLIERY AT WYOMING, PA.—ELECTRIC PUMP.

## Dissensions Among Anti-Bell Companies.

There have been several statements published of late indicating that the organization of anti-Bell companies at Pittsburg was not affected without some dissatisfaction among these who had hoped to have a voice in the councils of the new association. These announcements have been inaccurate and in most cases misleading. There has evidently been a desire to misrepresent the new organization, its purpose and plans, for it has been described as a "company," capitalized at $50,000,000, with the purpose of manufacturing and installing telephones in opposition to the Bell company. Of course no such organization as that thus described in the eastern papers exists. The *Electric Age* of New York has been misled by these announcements, for it refers to the organization as a company in the following item:

There is some talk of organizing an association of independent telephone companies and telephone manufacturers in the East, for mutual benefit. This proposed action is due to the failure of the National Independent Telephone company, just organized in Pittsburg, to grant eastern telephone interests as strong a voice in the affairs of the new association as the representatives from that section thought they should have.

These matters were brought to the attention of President Keelyn of the Telephone Protective Association of America and he has authorized the following statement:

There are a great many items floating around with reference to the amount of capital stock and the mission of the new Telephone association. I am unable to give you, at this moment, the financial strength of the combined companies in the new Telephone association, as quite a number have applied for admission since the meeting at Pittsburg, and will undoubtedly be admitted to membership.

The new association proposes to protect its members in such suits as may be brought against them upon patents alleging infringement in a more conservative manner than is generally supposed. If any member of the association is making a device which infringes the valid claims of Bell or other patents, the association will hardly consider it in duty bound to offer its protection. Each member should look well into what he produces and avoid infringement, or he will have to take care of himself. However, notwithstanding this, the association will render its aid to keep a properly constructed telephone apparatus in the market for the public.

Referring to the statement of "talk of organizing an association of independent telephone companies and telephone manufacturers in the East for mutual benefit," and the statement that "this proposed action is due to the failure of the National Independent Telephone company, just organized in Pittsburg, to grant eastern telephone interests as strong a voice in the affairs of the new association as the representatives from that section thought they should have," I may say that the eastern telephone interests are as largely represented in the new association as the western interests. The executive committee, which has practical control of the association's affairs, is made up of two eastern members and one western member, giving the East two to one. This shows how little credit these statements deserve.

The membership of the association is quite as largely in the East as in the West, so far as the directors are concerned. It so happens that there are considerable more telephone manufacturers in the West than in the East, and, therefore, the membership is larger; however, the eastern concerns were all given a reasonable opportunity of admission.

This question between the East and the West, in my opinion, has been raised because of the soreheadedness of two men who were given a full opportunity of equal representation in the association with other members, but who proposed to have the association run upon their own terms, and as the other members disagreed with their ideas, they felt chagrined evidently. These men have undertaken to establish an eastern association, and have written the eastern members of the new association to this effect. The eastern members of the association so approached have advised me that they would not think of going into another concern and were well satisfied that the present association would be successful. They thought the eastern sectional deal would prove a failure, which it undoubtedly will.

The new association is organized on broad, good business plans, and any soreheadedness on the part of any one eastern or western or southern or northern concern will cut no figure with its success. It is an assured fact that the very men who feel soreheaded at present will be very glad later on to have an opportunity of being identified with it if they continue in the telephone business.

ELECTRICALLY OPERATED COLLIERY AT WYOMING, PA.—MAP OF HAULAGE LINE.

## Telephone News from the Northwest.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

The Home Telephone company has about 250 instruments in operation at Sioux City, Iowa, and has contracts for 600 subscribers. President A. H. Hazen of the company says it is not engaged in a war with the Bell company, but merely trying to give good service. The indications are that the Bell company will indulge in a war with it, as a reduction in rates, taking effect July 1st, was announced some time since, but the amount has not been made public. E. A. Clark, the manager of the Sioux City office, has therefore been unable to send out bills for the quarter due July 1st, owing to having no schedule of rates. It is supposed that General Manager Cutter of the Iowa Union will personally inspect the field before making the reduction, which bodes no good for the independent company.

The Wisconsin Telephone company has applied for a telephone franchise at Baraboo, Wis.

The Globe Telephone & Construction company is the name of the company formed in Des Moines, Iowa, to manufacture and establish telephones and exchanges, using the invention of J. Serdinko, who has invented other electrical appliances. The company expects to sell the instruments at $10 each. The claim is made that they in no way infringe the Bell patents.

The Phœnix National Telephone company of Indianapolis has been granted a franchise in Eagle Grove, Iowa.

The Iowa Union Telephone company is building a line between Independence and Fairbank. It promises a considerable reduction in rates in Independence. A local telephone company has been formed there lately.

Manager Lashway of the Chippewa Falls, Wis., exchange is soliciting subscribers in Bloomer, Wis., with a view to putting in an exchange.

Joseph G. End, Arthur Winters and W. J. Johann have been granted a telephone franchise at Sheboygan, Wis.

The Southwestern Telephone company of Fairmont, Minn., proposes to connect with all the towns in six counties. It has applied for a 20 year franchise in Fairmont.

The village of South Sioux City, Neb., has granted a telephone and telegraph franchise to the Home Telephone company of Sioux City.

The Wausau Telephone company of Wausau, Wis., has purchased materials for the exchange and will rush work to completion as fast as possible.

The Blue Earth Valley Telephone company of Winnebago City, Minn., has been requested to extend east as far as Albert Lea and possibly Austin, and west to Jackson and Worthington, taking in all the intermediate towns; also to Mankato and to Wells. W. Z. Haight, proprietor of the Winnebago, City exchange has turned his property into the company and received stock in exchange.

City Electrician Palmer of Duluth has invented a switchboard by which the chief of police can at once connect his telephone with any point on the patrol system.

West Burlington, Iowa, wants telephone connection with Burlington.

Western Electrician.

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**CORRESPONDENCE** relating to electricity or any of its practical applications, is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

**ADVERTISING.**—THE WESTERN ELECTRICIAN **the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own*. THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

HIGH WATER MARK
CIRCULATION, 16,630.

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NEWS comes from New York that another telephone association, comprising eastern manufacturers, is being organized by some of those who were dissatisfied with the proceedings at Pittsburg. There have been numerous statements to this effect published in the eastern papers, and many of them have been inaccurate and misleading. It is evident that there is some dissatisfaction, but it is to be hoped that the differences existing will not prevent co-operation between the several interests in advancing the general welfare of the telephone business. It must be remembered that the anti-Bell companies will need all their ability and resources to successfully oppose the old concern, and they should not waste their time and energy in fighting among themselves.

ONE energetic member of the electrical fraternity of Chicago has already made arrangements for a trip to Japan for the purpose of promoting the interests of American electrical enterprises in that country, and there is no doubt that before long there will be a small army of American salesmen exploiting electrical apparatus in the domain of the mikado. We have already pointed out that there are great possibilities opened to American electrical engineers in the Orient by reason of the new Japanese treaty with China. Japan is certainly an inviting field in which American manufacturers of electrical apparatus can extend their export trade. The Japanese have shown a special desire to cultivate close commercial relations with us, but it is not to be expected that our exports to Japan will show material increase unless Americans make extraordinary efforts to push the sale of their manufactured products in Japanese markets. At the present time our Japanese imports are five times as great as our exports to that country, while England, Germany and France have sold Japan about twice the value of the products purchased from her. The Japanese consider America the greatest market for their wares and are anxious to cultivate her trade, and here is no doubt that this country would be greatly benefited by the establishment of closer commercial relations with Japan.

THE sixth convention of the Northwestern Electrical association, held in Chicago last week, again demonstrated the vitality and usefulness of this young and growing organization. The visitors were well repaid for their attendance at the meeting, and the out-of-town members can hardly fail to retain pleasant memories of the Chicago gathering. The papers were few in number, but practical topics were well presented and intelligently discussed. Mr. Abbott of the Chicago Telephone company advocated the double-trolley system, or at least a complete metallic circuit, for electric railways, and although many thought the idea commercially impracticable, his interesting paper was received with much attention. The address of the new president, George Grimm, who succeeds the lamented Henry C. Thom, is worthy of careful thought on the part of central station managers. Mr. Grimm contends that electric lighting and street railway corporations are themselves to blame, to a large extent, for the socialistic agitation in favor of municipal and state ownership, by selfishly and foolishly neglecting to pursue a broad, liberal policy toward the public, on whose favor they depend. This criticism is well deserved, in many instances, and it would be better for the electrical industry if it were taken to heart where needed.

BROOKLYN trolley cars have been creeping through the streets of the City of Churches recently at about the same rate as the old horse cars, which they replaced, owing to the action of the city council in regulating the speed of surface cars in compliance with the demands of the public. Now there is an organized movement among Brooklyn merchants to have this action reconsidered, and petitions are being quite extensively signed by those who are suffering from the slow-going pace now in vogue. Dry goods merchants and the Merchants' and Traders' Exchange are particularly interested in having the ordinance modified. The merchants say that the recent return to the old car horse rate of speed has had an injurious effect on their business, and that in view of the recent improvements by the trolley companies, the speed of the trolley cars can be safely increased. The members of the exchange say that the present low rate of speed is seriously retarding building operations in the suburbs and they recommend that a ten-mile-an-hour rate be allowed in the outlying districts. In this connection it is interesting to note that President Rossiter of the Heights road expects to have each car in the system equipped with a real life-saving fender within three months. Had the Brooklyn trolley companies given more attention to the demands of the public, even though they were at times unreasonable, they would have saved themselves considerable annoyance. The idea of the city of Brooklyn going back to horse car speed is really preposterous.

ONE of the latest discoveries in connection with the development and extension of the telephone business is the result which it has had upon the hotel business and consequently upon railroad business. It is no doubt true that much of the business that formerly required a trip to New York or Boston by Chicago business men is now transacted by means of the long-distance telephone. The rule works both ways. An observer of Chicago hotel business ascribes much of the dullness in the rotundas to this cause, and many of the hotel managers and clerks are disposed to believe that the theory is not only plausible but founded upon stubborn fact. It is explained that for some time there has been an appreciable decrease in transient trade affecting a class of business men who made it a point to arrange affairs within a day or two after arrival. They came from as far as New York, and the registers showed that they claimed most of the enterprising business towns within a radius of 500 miles as their homes. Business that could not well be consummated by mail or telegraph, but required personal consultation, necessitated journeys to Chicago, and of course the hotels and railroads benefited by these trips to the extent of from one to several days' board, with side issues for laundry, wine bills and extra meals. Now it is said that this sort of trade is almost wholly lacking among the local hotels. Many hotel managers have been interviewed by local newspaper reporters, and all agree that the long-distance telephone has had a depressing effect upon their business.

IT is our pleasure and privilege to peruse with regularity and attention the columns of our esteemed electrical contemporaries published in the city of New York. Notwithstanding our diligence in this employment, we have failed to observe the slightest intimation of a very remarkable electrical achievement which, we are informed, can be seen on the streets of that curious city. The innovation is so extraordinary that we feel impelled to give the source of our information, else we would not reveal the hurt to our national pride due to the inexplicable negligence of our eastern contemporaries. It is indeed annoying to await the Australian mails to get the electrical news from Gotham—a sad reflection on the enterprise of the technical journalists of New York, many of whom are kind-hearted, well meaning fellows—but one's patience is richly rewarded. Is it not worth while, for example, to learn, as we do from the *Queensland Electric Telegraph Gazette* of Brisbane, of the creation of an electrical successor to Frankenstein's monster? The *Gazette* gives these details:

A figure moving by electricity, measuring six feet in height and singing English songs and snatches from Italian operas, has been perambulating the streets of New York. The electric man moves his head, arms and legs as though instinct with life, and can walk about twelve miles an hour. The figure is attired in evening dress, with a white necktie, the boots are made of iron, with soles of very strong and durable leather. The motion of the arms and legs is performed with the greatest regularity, so that the automaton never loses its balance, even when going at a great speed. When singing its mouth opens and closes as occasion requires.

The electrical man is a fast walker, to be sure, and perhaps our New York contemporaries are a little slow, but we are still surprised that he got away from all of them. It is possible that he is the author of the machine-made ballads on electrical subjects that are turned out in New York; at any rate he has the gift of song, and he opens his mouth when he sings. He is an interesting creature, and we should like to hear more about him.

IT appears that the criticisms of this journal upon Supt. Barrett, his record in connection with the establishment of the city lighting plants, and his project to have the city secure control of commercial lighting plants and engage in the business of furnishing current to private consumers, have had the effect of stiring up that worthy official to something like a realization of the position in which he has placed himself. Unable to refute the arguments against his project, or deny the facts presented in support of the statement that the street lighting scheme had proved a miserable failure, Supt. Barrett endeavors to distract attention from the point at issue, and in his organ says:

Until City Electrician Barrett of Chicago became interested in the publication of an electrical journal, the enormity of his sins of omission and commission were not perceptible to the genial editor of the WESTERN ELECTRICIAN.

The city electrician of Chicago was never more mistaken in his life. His "sins of omission and commission" have long been perceptible to the editor of this journal and to everybody else who has followed the course of events of late years in electrical circles, but this journal, like many others who were kindly disposed toward Supt. Barrett, refrained from severely criticising that official, preferring to give him every opportunity to thoroughly test his policy as long as he kept within reasonable bounds. There has been no doubt of the ultimate result of this experiment, and it was expected that the city electrician would manfully acknowledge his failure to accomplish what he had set out to do or silently discontinue his efforts when he had demonstrated to his own satisfaction that he was mistaken. Instead, however, he now seems determined to continue, and with a recklessness born of desperation he advocates the adoption by the city of a policy that means ruin to vast interests and disgrace to the city. By this means he hopes to cover up his failure in the street lighting project.

It has been the object of the WESTERN ELECTRICIAN to point out clearly and unmistakably the danger in the adoption of such a policy. Heretofore, this journal has consistently opposed the municipal ownership of electric plants for street lighting, and now, when the greater danger is threatened, it is but natural that it should oppose this socialistic scheme. If Supt. Barrett's personal pride suffers by reason of the public exposure of his failure in the street lighting project, he has only himself to blame for the humiliation to which he has been subjected.

There is another matter, to which we have heretofore made no allusion, but which is now forced into this discussion by the statement already quoted, namely, the policy of the *Electrical Journal* and the connection of the city electrician with that publication. It is not at all surprising that there has been much unfavorable comment in the trade upon the action of Supt. Barrett in permitting the use of his name in connection with such an enterprise, and it is strange if some of the uncomplimentary remarks with which his agents have been greeted have not reached his ears. His best friends deplore his action in this matter, for they realize the equivocal position in which it places him. It is certainly to be regretted that after so many years of service and the enjoyment of so many honors at the hands of his associates, Supt. Barrett should allow his name and the influence of his position as the city electrician of Chicago to be used in connection with an enterprise that promises to bring him into discredit in the community. Supt. Barrett should withdraw from the newspaper enterprise or retire from the city service. As president and chief stockholder of the *Electrical Journal* he cannot with propriety solicit or accept advertising patronage for his paper from companies with which he has business relations as the representative of the city of Chicago.

## Chicago Convention Hustlers.

Of course the supply men were in evidence at last week's convention at the Leland, and naturally the Chicago men were at the fore. In fact, the Chicago salesmen formed the most picturesque feature of the convention. They were all life, joy, activity, good fellowship and—business. They kept things booming, made everybody feel happy and contented, did the honors of the town, and incidentally gathered in not a few orders. An electrical convention without a large contingent of irrepressible supply men would be a dull affair. The Chicago convention was far from being dull, and the faces of a few of those who were the life and color of the commercial side of the gathering are depicted below:

"Noisy" Bunce, more decorously known as A. C. Bunce, looked after the comfort of visitors, as a member of the entertainment committee, and the interests of the General Electric company at the same time. He had his hands full and was seen and heard of all men. Picturesque in raiment and voluble of speech, Mr. Bunce helped everybody to have a good time and made his exhibit a much-frequented one. "Noisy" Bunce is supposed to be about 40 years old, and he has sold supplies, as everybody knows, for the Edison General and General Electric companies for years.

"Doc" Edgar and W. D. Jameson were the "short and the long of it" in physical proportions for the Dearborn Drug & Chemical Works, but both are hustlers. This company made an exceedingly effective representation at the convention, and everybody came to know that it could supply a boiler compound suitable for any sort of scale formation. It is only lately that this successful concern has come to recognize the importance of the trade of the electrical stations, but it has now begun an active campaign that promises success.

"Billy" Low looked after the interests of the Electric Appliance company, of which he is president, at the convention. Mr. Low is one of the most experienced electrical supply salesmen in the West. Born at Flint, Mich., he first became known to the electrical fraternity 11 years ago through his connection with the Detroit Electrical Works, where he began as shipping clerk. Later he came to Chicago and associated himself with the Central Electric company, for which he traveled on the road a number of years. Four years ago he organized the Electric Appliance company. During the first two years of the existence of the company he was on the road, but owing to the remarkable growth of business, he gave up traveling to look after the sales department in Chicago. Mr. Low is one of the most popular men in the business and is a moving spirit at every convention which he attends.

W. R. Mason, who represented the Fiberite company at the convention, is a familiar figure in the electrical business of the West. He was one of the first to engage in the electric railway supply business in Chicago. At this convention Mr. Mason showed his eminent qualities as a salesman by talking sockets, switches, overhead railway material and other specialties of the Medbery insulation in a most convincing manner. Mr. Mason is general manager of the Mason Electric Equipment company, Chicago agent for the Fiberite company. Mr. Mason claims that he has always advocated and sold the highest grade of material obtainable, and considers himself fortunate in representing a material standing so deservedly high in the estimation of the trade.

Chas. D. Wilkinson represented the Western Electric company. Mr. Wilkinson is a young man, but his wide acquaintance throughout the entire country has made him a valuable member of that company's large staff of efficient representatives. Mr. Wilkinson has been connected with the Western Electric company for over 11 years, and at present serves as its traveling salesman, his territory being the entire portion of the United States west of Cleveland. His courtesy and geniality were especially noticeable at the convention, where he seemed to take particular pleasure in doing all he could for members and visitors alike.

Franklin Overbagh sells fixtures for the Chicago General Fixture company. He is an experienced electrical salesman, having been with the Weston, Bergman, Edison General and General Electric companies. He was born in New York state about 40 years ago, and is a pioneer in the business. Mr. Overbagh is modest where his own achievements are concerned, but he is considered one of the best posted men in the country on electric light fixtures. The tiny souvenir which he distributed at the convention was exceptionally neat and tasteful.

L. W. Burch, the energetic representative of the Metropolitan Electric company at the convention, is one of the most conscientious workers in the electrical supply trade. He was formerly with the Central Electric company, but when the Metropolitan company was organized Mr. Burch cast his lot with that concern. Mr. Burch has made a large acquaintance in the trade and is held in high esteem. He has devoted most of his life to electrical and kindred interests. He operated the first telephone switchboard of ten telephones in Detroit. He is a firm believer in the benefit to be derived from the gatherings of the National Electric Light association and the Northwestern Electrical association.

H. D. Latimer represented the Central Electric company at the convention. Mr. Latimer is one of the most capable men in the supply business and is well known throughout the Northwest. He is at present traveling salesman for the Central company and is recognized as one of the most energetic in the West. He has been connected with the Central company for about four years and has secured some of the largest orders which that concern has received. Mr. Latimer at one time had charge of the entire catalogue work of his company. He was always on the lookout for customers at the convention, and it is safe to say that no one who attended failed to hear of the Central Electric company's specialties.

## Convention Notes.

"Scrib" was "in it."

What was the matter with the searchlight?

That was a funny story McMynn told on Tatnall.

W. H. and W. C. McKinlock spent some time at the convention shaking hands with their friends.

The "yellow pine elephants" of the Chicago Cross-arm company were in unmistakable evidence.

W. D. Ball of Ball & Allen, electrical engineers, did the honors for his firm at the convention.

John Valentine, president of the Valentine-Clark company, Chicago, did the honors for his company with the greatest success.

H. R. Hixson, western selling agent for the Simplex Electrical company, Boston, extolled the merits of Simplex wires at the convention.

"Billy" Low, "Noisy" Bunce and "Charlie" Gregory formed the liveliest trio at the hotel. Mirth intermixed with "Paranite," General electric machinery and second-hand electrical apparatus, distinguished the peregrinations of these gentlemen.

Yes; George Cutter was present, as he is at nearly every convention. He was assisted by Albert Scheible in exploiting the Cutter specialties.

The Osburn Electric Supply company had a complete display of general electrical supplies, which was in charge of Henry G. and M. R. Osburn.

Lundell fans, as well as General Electric, Western Electric and many other makes, added greatly to the comfort of those attending the convention.

E. Nashold, "the cleat man," seemed to be everywhere at one time with his world of experience and innumerable tales of the excellency of the Nashold cleat.

Hart & Hegeman specialties were heard of on every side. Geo. S. Searing, their representative, lost no opportunity to give these specialties the credit which they deserve.

"Billy" Buckley of the Fort Wayne Electric corporation and author of "Electric Lighting Plants; Their Cost and Operation," favored the convention with a pleasant call.

H. O. Woodruff and L. G. Nilson represented the Sioux City Electrical Supply company and made an attractive exhibit of general electrical supplies, illustrated on page 42.

The Columbia Incandescent Lamp company distributed a circular of comparative lamp tests of Columbia and a competitor's lamps, in which the Columbia seems to have much the best of it.

Of course no convention would be complete without Geo. Conover, the western representative of the Perkins company. Energetic but unassuming, Mr. Conover is held in high esteem by his associates.

Few men labored harder than Secretary Wm. Goltz. Mr. Goltz not only performed his clerical duties with neatness and dispatch, but in addition had an eye to the comfort of his fellow members and visitors.

The Peru Electric Manufacturing company of Peru, Ind., was represented by its Chicago manager, J. H. McGill. This gentleman is a popular member of the electrical fraternity and was warmly welcomed.

Fred DeLand performed the duties of press secretary with ready discernment and good judgment. His services were highly appreciated both by Secretary Goltz and the representatives of the technical press.

L. W. Burch, of the Metropolitan Electric company, was constantly in attendance looking carefully after the interests of Metropolitan specialties, which found many heretofore unknown abiding places through Mr. Burch's untiring efforts.

F. Overbagh, manager of the Chicago General Fixture company, found time to drop in on the convention occasionally, although Mr. Overbagh has his hands full attending to the demand for the goods which this enterprising firm handles.

Jolly "Jim" Wolff, of Grimshaw and Black Raven renown, was one of the greatest favorites at the convention and was always in demand. Mr. Wolff, it is said, added several more "scalps" to the recent large orders for his well known wire.

The association honored itself and conferred a worthy distinction by electing Arthur V. Abbott, chief engineer of the Chicago Telephone company, to honorary membership. Mr. Abbott's paper on "Electrical Interference" received close attention.

S. F. B. Morse & Co. distributed a souvenir bearing the Kerite wire trademark, on which was printed the lamp series method of measuring high electrical pressure with a low-reading voltmeter, designed by F. L. Perry. This was appreciated by the lighting men.

C. L. Smith, of the Montana Electric company, Butte, Montana, was one of the visitors to the convention. He has been on an extended business trip for the last two months and has secured a handsome batch of orders. He reports business prospects as bright.

The Chicago General Fixture company distributed a neat little pamphlet, calling the attention of delegates and visitors, in a brief though emphatic way, to its well-known specialties. F. Overbagh and C. O. Baker were on hand to administer to the wants of their customers and friends.

Jovial "Aleck" Lewis, who is always sorely missed at any convention which he fails to attend, favored his old-time friends with a call at the Leland. It is needless to say that he was warmly greeted. Mr. Lewis is now representing the Cahall vertical water-tube boiler, with offices at 1105 Rookery, Chicago.

The members of the Northwestern Electrical association unite in thanking C. W. Dabb, proprietor of the Leland hotel, for his kind and unremitting efforts in their behalf. Mr. Dabb worked zealously to make every delegate to the convention feel at home and extended every possible courtesy to the members.

J. R. Wiley, western representative of the Standard Underground Cable company, greatly enlarged his circle of acquaintances at the convention. Mr. Wiley has met with pronounced success as representative for the Standard company in Chicago, and his cordiality has placed him in high esteem in the trade.

To delegates who were familiar with the operation of the huge electric light installation at the World's Fair, the face of George B. Foster was familiar. Mr. Foster is now hustling for Clark wires and cables and woven wire dynamo brushes. He is glad to see all of his old friends at 1651 Monadnock building, Chicago.

The Grier Brothers, western representatives of the Bryant Electric company, were a little late in making their

appearance at the Leland, but fully made up for lost time. As a result some Bryant specialties are now on their way to new places where they have been placed through the efforts of these energetic hustlers.

Genial S. F. B. Morse of Kerite fame was here, there and everywhere looking carefully after the interests of delegates and visitors, and was equally impartial to both in bestowing his attentions. No one did more toward making the convention a success than he, and all in attendance were indebted to his thoughtful attention.

Robinson & Troutman, Chicago agents of the Buckeye Engine company of Salem, O., exhibited a model of their engine, in order to show prospective users just "how it worked." The Buckeye engine is used by a large number of electric light plants in the West, for which the Chicago agents are in a large measure responsible.

C. E. Wilson was in charge of the interests of the Ft. Wayne Electric corporation and had on hand a large collection of photographs of his company's well-known machines, arc lamps and station instruments. Mr. Wilson was always on the "go" and never failed to make his appearance where he could do his company good.

H. J. Roberts & Co., electrical engineers and contractors, exhibited a new and novel boring tool which can be made to any desired height. This tool will be found very useful by wiremen. The company is located at 934 Monadnock, and it will be pleased to furnish any further information. John F. Connor is associated with Mr. Roberts.

The American incandescent lamp, manufactured by the American Electrical Manufacturing company, St. Louis, was represented by Louis Nahm, secretary of the company. The American lamp bears an excellent reputation, and is used throughout the entire United States. The success of the company is due largely to the efforts of Mr. Nahm.

George S. Searing, Chicago, sales agent for Gillespie & Tartt of Edwardsville, Ill., exhibited his company's new adjustable incandescent light balance, which is probably the latest novelty in the market. It consists of an acorn-shaped weight attachted to the lamp cord, by which the light can be raised or lowered at will. This unique article should find a ready sale.

M. B. Austin, the wide-awake representative of the Safety Insulated Wire & Cable company of New York, was always on hand to talk over Safety wire whenever someone could be found who was not aware of the excellent qualities of that well-known friend of the construction man. Mr. Austin has met with deserved success since becoming western manager for his house.

F. E. Drake, of the Standard Electric company, exhibited one of his company's latest arc lamps which attracted universal attention for its simplicity. This company is said to be the first to introduce the feature of all-night lighting by means of a single lamp mechanism, one carbon rod and a single pair of carbons. Mr. Drake explained the superiority of the Standard lamp to many interested attendants.

The Mason Electric Equipment company was on hand with a fine display of Medbery specialties, Phœnix filters, Knox circuit breakers, sockets, switches and a full line of general electric railway supplies. W. R. Mason looked after the exhibit personally, and the happy smile which he wore continually would indicate that considerable business had already resulted from his efforts. This exhibit is illustrated on page 42.

L. B. Allen was on hand with his well-known soldering stick to give a practical demonstration of the beauty of his specialty. This article seems to be meeting with great favor, judging from the large number of orders which he has received lately, and if economy is any inducement the soldering stick is certainly worth the attention of users. Mr. Allen was assisted by R. S. McMillan. The exhibit is shown on page 42.

J. M. Hill, Chicago representative of the Columbia Incandescent Lamp company and the Wagner Electric Manufacturing company, both of St. Louis, made no exhibit, as the Western Electric company, Chicago, which has adopted both the Wagner transformer and the Columbia lamp, looked carefully after these well-known specialties. Mr. Hill was kept busy looking after prospective customers, of whom there seemed to be quite a number.

B. Hartley, manager of the Hartley Electrical Works of 373 Dearborn street, Chicago, put in an appearance at the Leland and made the acquaintance of a number of the members of the association and convention visitors. Mr. Hartley is an old Westinghouse man and has had 12 years' experience in the business. He now devotes his attention to all branches of electrical repairing, making a specialty of rewinding armatures, and he reports business as excellent.

C. E. Woodruff & Co., 235 Lake street, Chicago, had one of the largest displays at the convention. It comprised flexible American circular loom conduit for electric wiring, which has become so favorably known throughout the West, and Reliance rubber covered wire. The exhibit, which is shown on page 42, was located at the WESTERN ELECTRICIAN headquarters, where Mr. Woodruff and his associates were kept busy explaining to visitors the superior points of their conduit.

The Royal Electric company, Peoria, Ill., was ably represented by G. G. Luthy, Frank Thone and J. West. These gentlemen were active and alert, and as a consequence all who had not known the strong points of the Royal apparatus are fully aware of them now. The Royal company has installed plants in the stations of a number of members of the Northwestern Electrical association, and it is confidently expected that the work of Mr. Luthy and his colleagues will result in several new plants being added to the list.

At the head of the stairs leading to the convention headquarters were two handsome constant potential incandescent arc lamps of the Western Electric company's make, which attracted everyone's attention. These lamps are of 2,000 candle power, and many were the comments heard on the steadiness of their burning. C. D. Wilkinson, who was in charge of the Western Electric exhibits, assisted by H. V. Smith, lost no opportunity in explaining the merits of these lamps, as well as showing the excellent display of fan motors, ammeters, voltmeters, switches, cut-outs, Columbia lamps, Wagner transformers and other electrical supplies. The company's new 25 ampere quick-break switches, together with its new voltmeter and calibrating ammeter switches, were attractive features of its exhibit.

J. Stedman, so well known to the electrical fraternity through his long connection with the Thomson-Houston and General Electric companies, is now western manager for the Page Belting company, with offices at 165 Lake street, Chicago. Mr. Stedman was on hand at the convention and exhibited a good many samples of slotted dynamo and other belting for all purposes. The Page belting has attained such a favorable reputation that success in his new venture is assured Mr. Stedman. The exhibit is shown on page 42.

A. C. Bunce, who has almost come to be considered the life of a Northwestern convention, had charge of the General Electric exhibit, with Messrs. Ferris and Wheaton. Two Thomson '93 constant potential arc lamps greeted the visitors to the parlor floor, while the Thomson wattmeter and a number of fine specialties were also in evidence, as shown in the illustration on page 42. A large collection of cut-outs, sockets, incandescent lamps of various candle powers, switches, fan motors, etc., was shown in one of the parlors.

The R. J. White Manufacturing company of 40 and 42 State street, Chicago, made one of the largest displays at the convention, but unfortunately it was located away from the main exhibits and probably was not seen by many of those at the hotel. The view of this exhibit will give the reader an excellent idea of the display. Handsome gas and electric fixtures were shown in profusion, as well as blow torches and furnaces for electrical workers, which are a specialty of this company. The exhibit was in charge of R. J. White and W. S. Hull.

The Electric Appliance "exhibit" was undoubtedly the most "magnetic" of all the attractions at the convention. It took the combined efforts of President W. W. Low, Frank McMaster, C. G. Wells, A. L. Millard and William Wilson to supply the demand for liquid "Paranite," imported and domestic "carbons," "Packard high-tension punch," and several other equally meritorious specialties which were furnished to consumers. It is needless to say that the Appliance company's room was a veritable Mecca. The company's convention staff is shown in the group on page 42.

The Hayes-Fyfe company, Pontiac building, Chicago, showed the workings of its new motor-starting rheostat which has just been put on the market. This device was illustrated in the WESTERN ELECTRICIAN of July 6th and was viewed with interest by the delegates. Messrs. Hayes and Fyfe were on hand to explain the working of their device and made a large number of new acquaintances. Although this device has been on the market but a few weeks, the company has no complaint to make of the number of orders which it has received. A view of the exhibit is given on page 42.

The Dearborn Drug & Chemical Works of 29 Rialto building, Chicago, made a large number of friends at the convention. They are manufacturing and analytical chemists and makers of boiler compounds, the latter being in use in a large number of plants. The Dearborn company was ably represented at the convention by General Manager Wm. H. Edgar and W. D. Jameson, who were particularly noticeable on account of their energetic "hustling" for their company. Pamphlets, blotters and souvenirs were plentifully supplied, but the generosity of the company was not thus exhausted. On the return of the party from the visit to the Metropolitan station Wednesday afternoon the entire group was invited to the office and laboratory of the Dearborn company in the Rialto, where the visitors were treated to cigars and claret punch. A bottle of fine perfume was also presented to each visitor.

Perhaps no exhibit at the convention attracted more attention than the new arc lamp recently placed on the market by the Standard Electric company of Chicago, and of which more than a thousand are now in use. In exterior appearance it is similar to the former type of Standard lamp, but when the cover is lowered the marked simplicity of the mechanism is apparent. As this lamp is a prime favorite with Mr. Perry, it was perfectly natural that he should find pleasure in debating on its good qualities; how the potential of the arc remained just the same regardless of the position of the clutch, the lamp magnets always being in perfect electrical balance; how an instantaneous and silent arc is always assured, and how the present arrangement of the magnets does away with the necessity of perfect cleanliness to insure economical and satisfactory service. It is claimed that the potential of the arc never rises above 50 volts or drops below 46, and though the amperes should vary from five to 15 still the arc will form silently and instantaneously at the normal voltage and so remain. As the contact points in the automatic cut-out are of platinum there can be no corrosion, and the lamp cuts out without a spark. For conducting the current to the carbon rod there is a substantial brush capable of carrying more than 20 amperes. The brush is so arranged that the friction upon the rod is reduced to a minimum. For outdoor service each lamp is provided with a double-pole weatherproof switch which is enclosed in a compact "detachable cap," and is so constructed as to permit the lamp being instantly removed from the line without opening or breaking the circuit.

## Inflated and Irresponsible.

[From the *Electrical Journal*, J. P. Barrett's educational publication.]

If our wind holds out—and we think it will—we can safely promise that the road in our rear shall be left clear for our friend.

## Boiler Feedwaters, Their Treatment.[1]

By W. D. JAMESON.

Water is a wonderful agent produced and given us by nature, and has its advantages and drawbacks; it is the greatest solvent of all natural or artificial liquids known to chemistry; it becomes impregnated with all different elements, in one form or other, in which it comes in contact, and absorbs free carbonic acid gas from the air and ammonia from the air and earth. Carbonic acid gas thus formed becomes the life of the water and enables it to take up the otherwise insoluble carbonates of lime, magnesia, etc., holding them in solution as bicarbonate of lime, magnesia, etc.; the colder the water and the heavier the pressure the more gas it contains; consequently the larger the body of water or the deeper the well the more heavily impregnated it is with the salts of lime, magnesia, etc.

All natural waters are imbued with the salts of the following mineral bases: lime, magnesia, sodium, potassium, iron, silica and aluminum, combined with carbonate, hydrochloric and sulphuric acids, and sometimes medicinal waters with phosphoric acid, or all of them to a more or less extent, according to the nature of the soil or the conditions in which the water percolates the soil.

The calcium, commonly termed lime, is taken up in the forms of sulphate and bicarbonate; the magnesia as bicarbonate, sulphate and chloride; the sodium and potassium as chloride, sulphate and carbonate; the iron as bicarbonate. Iron as well as copper is found in solution as a sulphate. The aluminum exists in the water as a sulphate or in suspension as an oxide; the silica as silicic acid. When we find a water containing sulphate of iron or copper in solution we generally find free sulphuric acid also.

The salts of lime and magnesia, iron, silica oxide, etc., are scale-forming ingredients; the sulphate of lime forms a very hard, compact incrustation, adhering very tenaciously to the hot metal, is very hard to break up, decompose or dissolve, and, like all sulphates, it is a very staple salt; it is conveyed into the boiler by the water as a sulphate, and as such enters the scale formation, and is not even soluble in its own acid and it is impractical to dissolve it with hydrochloric acid except in laboratory work.

The only substances which can be successfully used in the boiler to break up and convert sulphate of lime into a form in which it can be readily washed out are sugars properly blended, which, when used under the high heat and the existing conditions of the steam boiler, convert this sulphate of lime into a complex mixture of saccharates and carbonate of lime, and this, in the presence of the tannin matters, is practically converted into tannates of lime.

Carbonates of lime and magnesia enter into the scale formation as such, forming a very compact incrustation due to the great chemical affinity they have for hot metal, which is also the cause of the adhesive properties of sulphate of lime (gypsum). They can be readily and successfully converted into a complex mixture of tannates of lime and magnesia without any contamination to the steam or injurious effects to the steam receptacle or its connections.

Silica enters the scale formation as such and also as silicate of magnesia. Sodium salts enter into the scale formation only in small quantities. Being very soluble they remain in solution until the water in the boiler becomes supersaturated and unable to hold a greater quantity; these salts then cake on the hottest parts of the boiler, falling out of solution; this is very dangerous, having been the cause of the burning of a great many boilers in localities where the feed water is highly impregnated with soda salts. They cause internal corrosion, wasting away of the iron, eating through the joints and connections and are the cause indirectly of one class of corrosion of which I will speak later under another head.

Chlorides of lime and magnesia, found in some feedwaters, are very corrosive agents of the iron. Being very unstable salts, they readily decompose with the high heat into oxides of lime and magnesia, entering the scale formation as such. The free chloride combines with the hydrogen of the water as hydrochloric acid and has a direct corrosive action on the iron. The action of sulphate magnesia is very similar to that of the chloride under the influence of high heat. The sulphates of iron and copper are direct corrosive agents to the iron and boiler connections and will not enter the scale formation.

It is almost impossible to neutralize sulphates of iron, copper or magnesia in a practical manner. If you do it with soda, and convert the sulphuric acid into sulphate of soda, you get an excess of soda salts, which sets up galvanic action. If you use lime, converting the sulphuric acid into sulphate of lime, you get such large quantities of gypsum that in a short time your boilers will be so full of a hard incrustation that it will be impossible to run them. The only thing which has been half way successful in the handling of soluble sulphates and free sulphuric acid is a mixture of sugars and starchy matters of a complex organic nature, which have offset the action of the acid by breaking up the acid radical, taking the sulphur and incorporating it with the aid of some of its oxygen into its own organic compositions.

Speaking of sodium and potassium salts, I would ask if it does not look unreasonable to endeavor to treat water for the prevention of the scaling deposits by the use of sodium and potassium salts, yet these salts are, in 99 cases out of 100, the principal ingredient of the so-called boiler compounds and water purifiers, and it is these salts which cause most of the internal corrosion of steam boilers by their galvanic action.

Internal corrosion is the eating and wasting away of the threads, plates and joints, causing leakage and also causing the boilers and their connections to assume unsafe conditions. Where the corrosion is due to chlorine, free hydrochloric or hydrofluoric acids in the water, we find the pumps and feed pipes eaten through, the submerged parts of the boiler beeing free from such action on account of these acids readily passing off with the steam, and we get

1. Read at the convention of the Northwestern Electrical association, Chicago, July 18, 1895

a similar action again in the steam-exposed surfaces of the boiler and the steam piping.

Free sulphuric acid has a very similar action, attacking the feed pipes a great deal more rapidly than the boiler itself; its corrosive action in the boiler is more uniform and not so much of a pitting and grooving nature; its action in the steam piping having almost entirely a grooving appearance. Where the deleterious action is due to the presence of an acid, it is called a direct corrosive action, and is generally found prominent in the feed pipes (colder pipes) and in the steam exposed surfaces. Where the corrosion takes place mostly in the submerged parts of the boiler, it is generally an indirect action, due to an excess of salts or too pure a water, coming under the head of galvanic action, termed by electricians electrolysis.

The boiler, as it is generating steam, is also generating a certain amount of galvanic current. The boiler is a galvanic battery in itself, the valves and their brass connections, composed of copper, babbitt and other alloys, are negative, the iron being positive, forming the negative and positive poles, and under the high heat and other conditions existing in the steam boiler we have a galvanic battery; not only is copper negative to iron's positive, but the very molecules of the iron in the plates and tubes are negative and positive to each other; but electrolysis does not take place in the plate because the impurities, or we might say foreign matter, such as silicon, oxygen and carbon compounds, are not and do not act as conductors between these negative and positive poles: the water in the natural condition, that is, its chemical affinities and solvent properties, being satisfied with lime and other natural salts, will not act as a conductor between these poles, consequently, having no conductor, the battery is not connected by water, but when using distilled water, rain water, or water with an excess of sodium salts, we then have a perfect conductor, the water assuming the position of a battery and of a battery solution, connecting our negative and positive poles, and inciting and generating a galvanic current. We then have a true galvanic battery existing, due to the general make-up and influence in the steam boiler. The purer the water, or the greater the excess of sodium salts, the stronger our galvanic current, the more pronounced our electrolysis.

You well understand that water contains a very corrosive radical in the nature of a hydrate; the hydrate radical is HO. Water is composed of two atoms of hydrogen and one of oxygen, which is a very strong chemical combination, not readily decomposed except with a soluble metallic base or red hot metal, but in this case, under the influence of the galvanic current, the positive metal, which is iron, exercises a chemical affinity over the water, chemically combining with its hydrate, forming ferric hydrate, taking up the oxygen and part of the hydrogen of the water, freeing part of the hydrogen, which goes off with the steam. This ferric hydrate gradually converts into corresponding oxides, due to the high heat and boiling of the solution, gradually converting into the black magnetic oxide of iron, so named owing to the galvanic action in its manufacture; its physical properties are that of of a black gritty powder found at the bottom of the boiler when washed out, when electrolysis is going on. If you will take a boiler that is pitting from this cause, you generally find zigzag pits and grooves coated over with a baked film, and by tapping these with a hammer you find a reddish brown soft powder underneath, which is the more freshly formed ferric hydrate; that of a lighter shade is the partly converted oxides, and the few handsful of black gritty powder from the bottom of the boiler, which you can examine after rinsing the other oxides from your hand, you will find to be the black magnetic oxide of iron.

Speaking of electrolysis, which we, from our standpoint, term galvanic action, we believe it truly exists as such, and to prove it consider the large ocean-going vessels and think of the trouble they have from this cause and how and why they treat it. They use tons and tons of zinc to offset this very action, due partially to using too pure a water on account of the hot well system, and further by what salt water they are compelled to use. We all know zinc to be one of the most positive metals known in galvanic battery work; it is more positive than iron. The zinc put into the boiler assumes the position of the positive pole, consequently it is destroyed in place of the iron by the battery solution in the steam boiler. Its reaction and conversion into its oxide are similar to that of the iron, it being destroyed under the same influences.

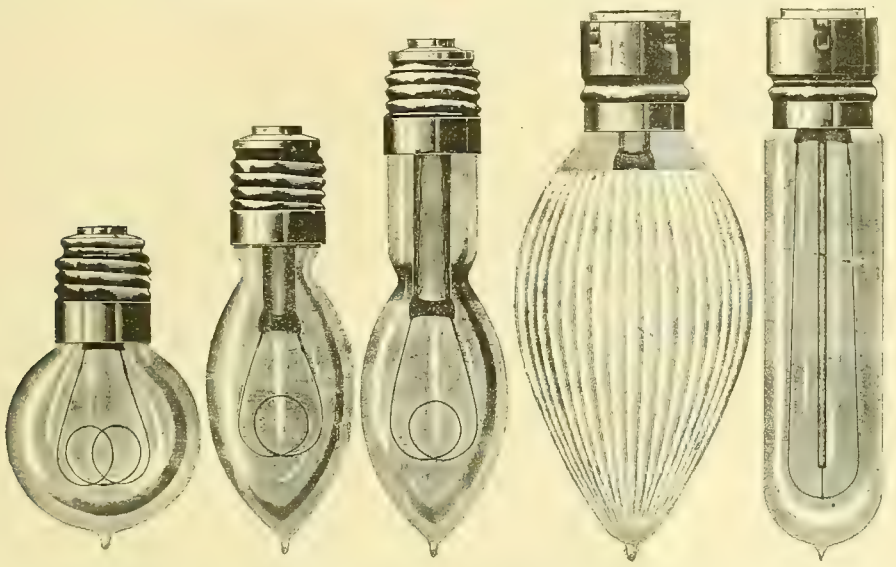
Of all the deleterious actions which take place in steam boilers this is the easiest to handle, for you simply need to satisfy that water with some vegetable starch and saccharine matter, and in that way break up your conductor between the negative and positive poles, whether they be brass connections (negative) and the boiler plate and flues (positive) or the molecules of the iron of the boiler plate. It is impossible to set up a galvanic action without the water assuming the position of the battery and acting as the conductor. This same saccharine inert matter in conjunction with tannin extracts will cause these pits and grooves in the iron plate (where the case hardening protective surface of the plate and tube is broken and the raw steel or iron exposed) to heal over, assuming that same case hardening appearance as before. Do not understand me to say that you can fill up the little holes, as that cannot be done, the iron being gone, but the surface of these little zigzag holes and pits will heal over, serving as a protection against the water or the atmospheric oxidation.

Scaling ingredients are converted from crystallizable scale-forming carbonates and sulphates, having a great affinity for hot metal, into non-crystallizable tannates and saccharates of lime and magnesia, being a complex mixture of these with some carbonate, the sodium salts being readily handled in the same manner. This complex mixture of the saccharates, carbonates and partially converted tannates is of an inert nature, having the physical properties of a soft oozy mud of the same specific gravity as the water, and no affinity for hot metals, neither has it the claylike properties, but it will readily wash out with the water when cleaning the boiler.

In conclusion I might say a few words relative to the deleterious action of oil in steam boilers. Many of you today are running large condensing plants with your hot-well systems, and you are getting oil, with the condensation, into the boilers, possibly five to 15 drops per gallon. These oil separators are a good thing and do, possibly, 50 or 60 per cent. of the work. You often hear of the tubes in a water-tube boiler buckling up and having to be taken out; you often hear of the bagging of the fire-sheet in tubular boilers. Why is this? The specific gravity of the oil is lighter than that of the water; the oil does not settle in its natural state. We explain it as follows: The oil coming into the boiler floats on the water; there is just a sufficient quantity of fresh water coming in to convey salts of lime, magnesia, etc., which are thrown out of solution, chemically combining with the animal oil as insoluble oleates, and mechanically combining with the mineral oils as a heavy mass, both these chemical and mechanical combinations being of a greater specific gravity than the water in the form of little globules, sinking to the bottom, the great chemical affinity and adhesive properties of this mixture causing them to adhere to the hot metal, and they, being a perfect non-conductor, retarding the transmission of the heat units to the water, concentrating the heat in that part of the plate, causing the iron to melt, and the pressure in the boiler forces it down.

Sodium salts, so commonly found in water, or where it is used to counteract this action, saponifies the oil, causing the boilers to foam and carry over into the engines, and should not be used. This defect can be successfully handled with tannin extracts, the tannates forming complex organic compositions with the oils of an inert, light, powdery nature, having no chemical affinity or physical adhesive properties and readily washing out with the water at the opening of the boiler. To prove this go to the tannery and watch the tanner take the hides out of his vat after he is through with the tanning process, and when he lets the liquor run out of the vat you will find two or three scoop shovels full of an inert powder, which readily dries out and is termed pure tannin by the tanning experts. They claim that this is insoluble and are in want of a solvent so that they can successfully use it for its tanning properties. We do not believe this to be the case, as the tannin in this mixture is, chemically speaking, part of the mixture, and the tannin is satisfied by the fatty matters contained in the hide. We aim to get this same reaction with the oil by pumping into the boiler a properly blended mixture of slippery elm, starches, sugars and tannin extracts.

We have found that we can successfully cope with most of the deleterious actions taking place in steam boilers with vegetable matters, and vegetable matters only, sometimes using from 5 to 10 per cent. of carbonate of soda to partially cut the starches and aid in the action of the sugars, but, correctly speaking, we are vegetarians on this subject, and do not believe that perfect results can be obtained from any other methods known to science.



FIGS. 1 TO 5. SPECIAL FORMS OF BUCKEYE LAMPS.

## Special Forms of Buckeye Lamps.

The Buckeye Electric company of Cleveland has completed a line of investigation and experimenting with special forms of incandescent lamps, and as a result has made arrangements to place on the market several styles designed for special work. These include lamps for decorative and ornamental uses as well as unusual commercial requirements. The accompanying cuts give a fair idea of the appearance of these lamps. Fig. 4 shows the

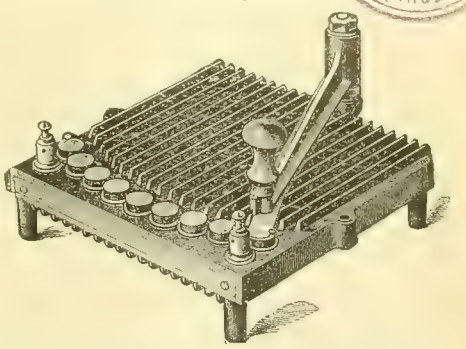


FIG. 2. CLIMAX IRON CLAD RESISTANCE SPECIALTIES.

ornamental lamp, which is made frosted and plain in voltages ranging from 48 to 130, and giving eight to 16 candle power. A special commercial lamp for breweries and distilleries is illustrated in Fig. 5. It is known as the bung-hole and is made both for high and low voltages, the former giving 16 candle power and the latter 10 candle power. The short "candle flame" and the long "candle flame," shown in Figs. 2 and 3, are designed for ornamental work and are rated for 10 candle power. The lamp shown in Fig. 1 is known as the imperial decorative lamp, eight to 16 candle power and taking 48 to 130 volts. These lamps are frosted or plain and are dipped in blue, green, ruby or amber, as desired. In the tests that have been given these lamps they have proved very satisfactory and the Buckeye company anticipates a lively demand for these special forms.

## Climax Iron Clad Resistance Specialties.

The specialties of the George L. Colgate company of New York have come to be regarded as standard for this line.

In stage regulators (lamp dimmers) the rheostat itself and

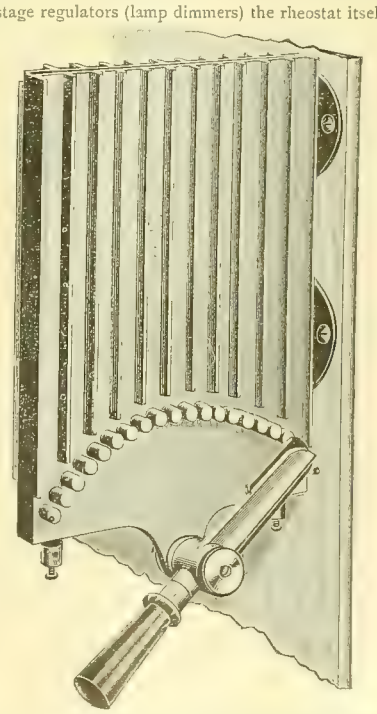


FIG. 1. CLIMAX IRON CLAD RESISTANCE SPECIALTIES.

the switch with contact points are all in one. They are particularly designed for the limited space in the wings of a theater, taking up no more room than the switch alone of the old style dimmers. The throw of the switch is so proportioned that where several dimmers are installed any or all of the dimmers may be thrown in simultaneously. Fig. 1 illustrates this device. The company makes motor starting boxes, motor controlling rheostats, dynamo field regulating rheostats, theater lamp dimmers, standard and special electric resistance. All these boxes are made entirely of cast-iron, inside of which, hermetically embedded and sealed

in a solid insulating material, are the resistance wires. These are so disposed that, while thoroughly insulated from, they are in the closest possible juxtaposition to the iron shell. This shell, acting as a radiator, safely and rapidly dissipates the heat caused by the electric current passing through the resistance wires. Starting boxes, Fig. 2, can be fitted, when desired, with an automatic magnetic release, which is a very valuable and efficient safeguard both to the motor and to the generator.

## COMMUNICATION.

### Regulation of Power Generators Driven by Water.

*To the Editor of the* WESTERN ELECTRICIAN:

I read with great interest an article in your issue of July 20, 1895, entitled, "New Method for the Better Regulation of Power Generators Driven by Water." This method is very good indeed, but it is not new, as the following quotation from my paper, "Practical Notes on the Electrolytic Refining of Copper," read before the American Institute of Electrical Engineers, June 6, 1892, will prove: "A few words as to electric generators may not be out of place. The author prefers separately excited machines for the reason that they cannot be reversed and other incidental advantages. When water power is used as prime mover a good deal of trouble has been experienced in the regulation of the wheels. As a matter of fact there is no water governor in existence which will regulate so perfectly as the governor of a modern automatic engine under varying loads. By running all the exciters from an independent prime mover (either water or steam) the strength of the fields of the generators will be uniform at all times whether there are fluctuations in the external circuit or not. The strength of the field of the generators which, with self-exciting machines, is subject to the fluctuations in the external circuit, and is a variable, becomes a constant. The author proposed this arrangement over three years ago for railway and power stations with the very best results."

F. B. BADT.

## CORRESPONDENCE.

### New York Notes.

NEW YORK, July 20.—The success which has attended the installation of the apparatus and electric locomotive to be used in the tunnel of the Baltimore & Ohio railroad at Baltimore, Md., has occasioned a large amount of discussion among officers of steam railroads in the East, and it is rumored that the Pennsylvania Railway company is now investigating the practicability of using electricity in connection with switch engines at the Jersey City terminal, while the New York Central Railroad company is considering the use of electricity on a number of suburban lines, having in view especially the service between New York City and Yonkers for its first trial. It is also said that the New York, New Haven & Hartford Railroad company is receiving such good reports of the Nantasket Beach route, of which mention has been made in this paper, that the company has under consideration placing electric service upon the suburban trains between New York and New Rochelle and possibly Port Chester. The possibilities for the use of electric locomotives on the several branches of the Long Island railroad have also claimed the attention of this company, especially in reaching Coney Island and Manhattan Beach.

Nothing in the way of traction work has so occupied the public mind as the successful operation of the electric locomotive, and it is reported that a number of the most prominent inventors and mechanical engineers are turning their attention to this new branch of the business. In a recent interview with Prof. Baxter, one of the pioneers in railroad work, he stated that he had for the last year been spending a large share of his time in looking up necessities required for motor work of this kind, and that the encouragement received from leading railroad officials of the country was exceedingly gratifying, and also that not a few builders of steam locomotives were investigating the subject with special reference to the adaptability of their plants to handle this new line of work. Prof. Baxter has a large amount of data and information, the results of experiments that have been conducted abroad as well as in this country, together with that which he has gathered himself on this subject; and he believes that the improvement and progress in this line of traction work will be fully as rapid as that which has been seen in the street railways.

A number of the leading telephone manufacturers east of Pittsburg had an informal meeting recently, with the view of forming an association similar to that organized by their western competitors. A meeting will be called in the near future to complete this organization, wherein it will be agreed to defend all interests which are mutual in the telephone business. W. F. O.

### New England News.

BOSTON, July 20.—One of the laws passed by the Massachusetts Legislature at its last session provided that all poles and posts for the transmission of electricity should be insulated in such a manner as to protect employes and other people from accidents. The commissioner of wires was empowered to enforce the law, and under the act he is also "sole judge of what constitutes proper insulation." The number of poles and posts carrying electric wires in this city is nearly 14,000, of which the lamp department has 2,478 for the lighting of streets. Several weeks ago the superintendent of the lamp department began his study of how to insulate these poles, and as a result has invented a device for insulation which, he thinks, will save the city many thousands of dollars. Last month Superintendent Buckner thought he had solved the problem, but the pole he had insulated did not stand the test. A new method of insulation has since been tested which has proven very satisfactory. This pole was tested in the yard of the Brookline electric power station, in Allston. It is in two parts of wrought-iron pipe, about 20 feet high. From the first joint to the top is about 10 feet. This is covered with a fiber jacket of wood pulp and other material. Around it are clamped the iron steps for climbing, none of the bolts entering the insulating compound. At the top of the pole is a wooden plug that goes down into the pole two feet, leaving nine inches projecting above. To this plug is bolted two iron rod braces, which support the hood of the arc lamp, but there are several inches of the wood plug exposed between the iron of the braces and the ironpole. This plug has been treated chemically so as to make it absolutely non-conducting, and also to preserve it from the effects of the weather. At the test, besides the electricians of the Boston wire department, there were present Superintendent Morris W. Mead of the Bureau of Electricity of Pittsburg, Pa., and Electrician S. G. Splane of the Standard Oil company pipe line, who were in Boston studying the subject of electroysis. The pole and its insulation stood each test perfectly. The voltage used was 1,260. The first test was to determine whether the pole was properly grounded and the second test was of the pole in its normal condition, dry, and to see if the insulation of the hood from the pole was perfect. The full force of the current was used and the measurements made showed that none of the current passed through the hood of the pole. A hose was then brought out and the pole, hood and insulating jacket were thoroughly wet down. This was for the purpose of testing the insulation of the outside of the pole. The test of the plug resulted the same way. A test was next made to ascertain if a man standing on the steps with his hands on the hood or braces could receive a shock. This was satisfactory, as was also the last test of the grounding of the pole, when it was found that no changes had occurred in the conditions first ascertained. The pole will again be tested later.

Electricians Mead and Splane were much gratified with the tests and continued their inquiries as to the effect of electricity upon underground pipes, which subject they have been investigating during the last six months. To a reporter they stated that they had discovered three methods for overcoming the evil. One is by attaching the negative side of several of the power station dynamos to copper return wires connected with the several pipe systems, consisting of gas and water mains. The positive poles of the same dynamos connect to the trolley and feed wires as heretofore, but they do not connect to the rails or the return wires. The other dynamos in use at the power stations connect to the rail and to the feed wires as ordinarily. The dynamos which connect to the pipes carry from 15 to 20 volts higher pressure than those connected to the rails, making the pipes negative to the rails all over the city. This system, they stated, has worked successfully in Newark, N. J. The method most satisfactory is that suggested by the committee appointed at the convention of the International Fire Chiefs' association in Montreal last fall to consider the subject of electrolysis, of which Mr. Mead is a member—to have a copper return wire parallel to the railroad in ducts heavy enough to take up the return current, and make a continuous copper wire large enough to take up the rail current and join the rails perfectly. The trouble is that the rails have not had enough capacity and have not been bonded and joined properly. When out of joint electrolysis has taken place, so that the true plan is the return heavy copper wire. At the manholes they can connect the lead covering of all electric cables with this return wire.

The Edison Electric Illuminating company of Boston has voted a dividend of 1¾ per cent., payable August 1st, to stockholders of the record of July 16th. This is an increase in the dividend rate from 6 per cent. to 7 per cent. per annum. C. S. G.

### Milwaukee, Wis.

MILWAUKEE, July 20.—The present contract of the city with the Badger Illuminating company will expire January 1st, and unless it wants to have many of its streets dark or desires to go back to old methods of lighting streets, the city will have to advertise for bids for electric street lights for another period, as it cannot possibly establish a municipal lighting system before the expiration of the present contract. More than 1,000 arc lights will have to be furnished under the contract, and the Board of Public Works is preparing to get as low bids as possible. An effort will be made to get outsiders to figure on the contract with a view to having them construct a plant in case they should be found to be the lowest bidders. It has not yet been decided whether the contract shall run for two years or longer. The city now pays the sum of $112.50 per lamp a year, and some of the city officials are hopeful of getting bids as low as $90 a lamp. Why they can expect low bids, or even competition, in the face of the project for the establishment of a municipal lighting plant is more than it is easy to fathom. It may be that in order to create competition the city will provide for the purchase of the plant at the end of the contract time. There is a question, however, whether the new plant could be erected in time for the lighting of the streets by the time the contract of the Badger Illuminating company expires. Of course, an arrangement might be made with the Badger Illuminating company to furnish light at the present prices until the new plant is ready.

The city now requires that all new electric light wires in the city shall be placed underground. It is now proposed to require only wires in the business district to be buried, and it is believed that on this account bids will be lower than they would otherwise be. The danger from fire in the outlying districts would not be materially greater on account of this change, it is asserted, and it would promote competition and would destroy the monopoly of the Badger Illuminating company. City Engineer Benzenberg, who for some time has paid special attention to electric lighting, is of the opinion that the city ought to have its streets lighted by electricity at the rate of $90 a lamp a year. When the city entered into the present contract it was using only 480 lamps and now it is in a position to contract for at least 1,000.

The proposition to require the Milwaukee Street Railway company to sell 25 tickets for $1, which was again revived recently by Alderman Thuering, who is one of the most determined opponents in the Common Council of the street railway interests, has once more received its quietus, the vote standing 14 to 21. Alderman Thuering succeeded, however, in having the council pass a resolution censuring Henry C. Payne, the receiver and vice-president of the Milwaukee Street Railway company, for his utterances at the time that the company went into receivership. It will be remembered that Mr. Payne stated that one of the principal causes of the receivership was the threatened adverse legislation in the Common Council, which harrassed the company very much and prevented it from borrowing the money it needed to carry on its business. Mr. Payne afterward reiterated the statement. The council denounced the statement as untrue in every respect, and declared that it was unjust to the council and to the city of Milwaukee as well. The action of the council has not appeared to bother Mr. Payne very much.

The electric railway lines of the city did an enormous business on the Fourth of July. The number of people carried during the day was 184,100. The number that paid their fares was 135,500 in round figures, leaving 48,600 that were transferred after having paid their fares. The number of transfers issued on July 4, 1894, was 27,400, so that there was an increase of 21,200 in the number of transfers. The increase in the number of people who used the street cars, as compared with July 4, 1894, was nearly 25 per cent. The gross income for the day was about $6,775. Receiver Payne asserts that the income was not what might have been expected from such a business. On account of the transfers, he said, the receipts did not correspond with the increase in business. It costs a great deal of extra work, especially extra detail work, Mr. Payne says, to provide for the transfers, to say nothing of the extra service that the people get and the extra cost of giving them that service.

In the United States Court at Milwaukee, Edward W. Andrews of Seattle, Wash., has sued for the appointment of a receiver for the Racine Light company. He alleges that other members have conspired to reduce the value of his stock and that they have loaned money to themselves and paid themselves large salaries. The defendant controls the Fond du Lac Gas company and the Oshkosh Gas Light company.

The management of the Milwaukee Street Railway company is at work upon a plan for the organization of all the employes of the road for the purpose of instruction in matters pertaining to the construction and operation of an electric railway, for the help of the sick and the disabled and for the promotion of good fellowship. All the members are to have an equal voice in the election of the officers of the organization and in its management. The cost of membership is to be nominal, the understanding being that the company is to bear a large proportion of the expense in order that the individual cost be as low as possible.

There are now two street railway unions in the city instead of one. A new union, comprising the electrical street

railway workers, was recently organized. Every effort was made to have them join the regular union, W. D. Mahon, the president of the national organization, coming here for the purpose, but when it was ascertained that the electrical workers on the street car lines were determined to have a union of their own, arrangements were made to promote harmony between the two unions. The new union soon had 100 members.

The Edison Electric Lighting company has decided to establish a sub-station for the South Side near the corner of Grove street and National avenue. It will simply be a distributing station, to cost not more than $15,000, the power to be sent to it from the Edison power house through a direct high-tension main. A transformer at the sub-station will control the supply. Seven new sub-marine cables will be placed under the river at East Water street in connection with the sub-station. Five new cables will be laid across the river from the power house to West Water and Chestnut streets and three armored cables will be laid from the power house along Oneida street. These will provide for the lighting of many private residences with incandescent light. The company finds a growing demand for incandescent lights and the improvements will give an additional capacity of 5,000 lamps. The company has ordered from the Edison General company two 200 kilowatt multipolar generators and from the E. P. Allis company of this city a 550 horse power compound engine. The improvements will cost $75,000.

It is expected that the party headed by Congressman Lawrence McGann of Chicago and ex-Congressman P. J. Somers of this city will apply to the Common Council next Monday for a franchise to build a line clear through the city in opposition to the Milwaukee Street Railway company, which enjoys a monopoly at present. The idea of the promoters is to begin at South Milwaukee, tap Cudahy and Bay View, and thence proceed to the northern city limits. At Bay View it is proposed to tunnel under the tracks of the St. Paul and Northwestern railways, cross the Kinninckinnic river at Lincoln avenue, and thence run along Hanover and Florida streets, Broadway and Huron and Milwaukee streets, Ogden avenue and Cherry and Sixth streets to the northern city limits. Mr. Somers declares that he and his associates are thoroughly in earnest. He says that the fare from any point in Milwaukee to Cudahy will not be more than 5 cents, and that in all probability the fare for the trip clear through to South Milwaukee will not be more than 7 cents. There is considerable talk of a 4 cent fare, at least in the city. It is understood that during his recent eastern trip Mr. Payne placed before his associates in the Milwaukee Street Railway company the project of building to Cudahy if not to South Milwaukee, and the company recently formed, as well as the party headed by F. W. Rogers and E. M. Spaulding, is after a franchise from Cudahy.

The reorganization of the Milwaukee Street Railway company seems to be assured. Advices from New York state that about 90 per cent. of the bonds and stock of the company have been deposited with the Central Trust company, and that the plan of reorganization has been declared effective. It is announced that further deposits under the reorganization plan will be received only upon the payment of $10 for each bond and $1 for each share of stock. The new bonds of the company, it is expected, will be salable at a high figure.

An interesting story comes from New York in regard to the Milwaukee Street Railway company. It is to the effect that while all the indications are that the various Milwaukee street car lines were bought with North American company money, the North American company has never had a clear title to the properties. The management of the North American company, it is said, explains this by stating that the North American company was simply a member of a syndicate that bought the various street car lines. North American stockholders, however, are asking how it happened that certain German banking institutions, which were supposed to be members of the syndicate, became large creditors of the North American company some three months after the purchase of the Milwaukee street railway properties. It is charged that Villard, without a doubt, paid the former owners of the lines—old associates of his—thousands of dollars more than the properties were worth. Among these associates were Thomas F. Ryan, who is now a director of the Metropolitan Street Railway company of New York, and Walter G. Oakman, now president of the New York Guaranty & Indemnity company of New York, who was the president of the old Milwaukee City Railroad company.

A funny thing in connection with the troubles of the Milwaukee Street Railway company is the attempt of John S. Schantz, formerly of Milwaukee, to get control of the North American company, with a view, it is said, of taking a hand in the reorganization of the Milwaukee Street Railway company. Schantz worked hard getting proxies from North American stockholders for the purpose of preventing the re-election of the present management of the North American company, and even went into court in regard to the matter, but was unsuccessful throughout. Schantz is remembered here as the pioneer promoter of Milwaukee. He came here about eight years ago. He tried to take a hand in the sale of Milwaukee street railway lines, and a suit brought by him against John A. Hinsey, now of Chicago, to recover a large claim for negotiating a loan upon the old Hinsey electric line, is still pending in one of the courts here.

In the Milwaukee Street Railway company case the Central Trust company of New York has filed a supplemental complaint in its receivership suit. The complaint contains 100 pages, but simply alleges the default of the June interest, aggregating $228,000.

A few days ago fire that is supposed to have originated from a spark from a trolley partly destroyed the street railway station at Lake park. The loss was about $500.

The Board of Public Works has received bids for the clock which is to be placed in the city hall tower. The Howard Watch & Clock company of Boston offered to provide dials 14½ feet in diameter for the tower and small dials for the interior of the building for $3,990. The big dials will be illuminated by electricity and the interior dials will be operated by electricity by minute impulses from the tower clock. The Johnson Electric Service company proposed to put in one of its pneumatic tower clocks, with other clocks operated by electricity in the different offices in the building, for $1,850. There were several other bids.

Electricity cuts quite a figure in the remodeling of the T. A. Chapman company's dry goods store. Two handsome electric elevators, made by the Crane Elevator company of Chicago, have been put in the store. The company will be able to operate the elevators, to supply its own light and to regulate the heating apparatus with power from a new plant of its own, one of the most improved in the city. Electric fans are used in ventilating the store, the air being renewed every 15 minutes. The plant in the basement includes two 70 horse power boilers, two 70 horse power engines and five dynamos. All the work was done under the supervision of George Gibbs, the mechanical engineer of the St. Paul Railroad company.

The Thompson company, otherwise the Wisconsin Inter-Urban company, has temporarily retired from the contest for the Fox river franchise in favor of Messrs. Elmore and Vanderzee of Green Bay. The inter-urban project continues to be so complicated that the end cannot be foreseen.

C.

## PERSONAL.

William Pike, Jr., formerly superintendent of the Brady Manufacturing company, has resigned and is now taking a much needed rest. He will be succeeded by Oluf Tyberg, mechanical engineer, so long and favorably known as a practical and theoretical designer and the constructor of many automatic and other labor-saving machines. Mr. Tyberg recently acquired an interest in the Brady company, and he will be pleased to meet his friends and patrons at 83 Washington street, Brooklyn, N. Y.

## ELECTRIC RAILWAYS.

According to the *St. Louis Globe Democrat*, a deal has been practically consummated in London involving not only the consolidation of the principal street railroad interests of St. Louis, but also the purchase with English gold of all or nearly all the street railroad plants and franchises in the Mound City. When the Mound City and Benton-Bellefontaine street car systems were absorbed by the Union Depot company, the negotiations were repudiated by all parties concerned, until secrecy became no longer possible and the actual terms of the consolidation became public property. It is well known that James Campbell, who engineered the deals whereby the Union Depot company secured control of the two northwest St. Louis lines, and more recently of the Grand avenue cross-town franchise, has been working for at least three years on a grand consolidation scheme, whereby all the street railroad interests of the city should pass into the control of one corporation.

## POWER TRANSMISSION.

Work is fast progressing on the electric power transmission plant which is to carry power from the North Fork of the San Joaquin river, 33 miles, to Fresno, Cal. It is to be in operation within 120 days and is to deliver from 1,000 to 1,200 horse power. It will supply 1,000 incandescent lights, 160 arc lights and motors for flour mills, planing mills and various other purposes, with a reserve for street railroads. A column of water, only 18 inches in diameter at the bottom, falling down a precipice 140 feet, will develop the power.

## TELEPHONE.

The Northwestern Telephone & Electric company of Milwaukee will begin work on the telephone exchange of the Oshkosh Northwestern Telephone company at Oshkosh, Wis., at once, and expects to complete it in four or five weeks.

The Phœnix Telephone company expects to have the Mason City, Iowa, line in operation by September 1st. It has secured about 100 subscribers.

The Phœnix Telephone company of Indianapolis has secured a telephone franchise at Ft. Dodge, Iowa, and will enter into active competition with the Iowa Union Telephone company.

## TRADE NEWS.

The Universal Telephone company of Indianapolis, Ind., has collected a number of testimonial letters from well-known business concerns that have been using its instruments, and published them in pamphlet form. There is no better evidence of the popularity of this system than such testimonials as these.

The Mercantile Trade List Supply company, 601 Times building, Pittsburg, Pa., makes a specialty of furnishing lists of the names and addresses of persons engaged in any trade, profession or occupation in any state or territory in the United States, including manufacturers, wholesalers, retailers, etc., for mailing of circulars, catalogues, samples and pamphlets. The company also furnishes addressed envelopes, wrappers, etc., taken from lists at reasonable rates.

In an article describing the electric locomotive and power plant of the Baltimore & Ohio railroad, it was erroneously stated that the "Lux" drip system was used instead of the "Holly" drip system. The Holly concern has headquarters at Providence, R. I., and reports that orders have been so large of late that new quarters are demanded to meet this increase of trade. A large number of their special device have been placed in some of the leading electric light and power plants.

The Electric Appliance company is exhibiting a beautiful line of fancy styles of the Upton arc lamp which it is now prepared to supply for direct and alternating constant potential circuits, and also for regular series arc work. The fancy lamps are beauties, and everything considered are not expensive. The regular standard Upton lamp is a very business-like affair, and on this the Appliance company claims to be making prices that are decidedly interesting. The company has a large stock in Chicago ready for prompt shipment.

The Chicago General Fixture company, 169 Adams street, Chicago, is preparing to increase its traveling force for the purpose of covering more fully the central and western states in the sale of the excellent line of electrical supplies and specialties which it is handling, and especially to push the sale of the Phœnix transformer, manufactured by the Louisville Electrical Works, Louisville, Ky., for which it has taken the exclusive ageny in Illinois, Wisconsin, Michigan, Iowa and Northern Indiana. The Phœnix transformer is rapidly growing in popular favor on account of its many excellent and unequaled qualities and its manufacturers are preparing to meet the extraordinary demand for it which is bound to come in the fall, as the daily increase in sales evidences.

## BUSINESS.

G. W. Conover, western manager of the Perkins Electric Switch Manufacturing company, has just returned from an extended trip through the Northwest, where he secured some flattering orders. If indications are a criterion, Mr. Conover says business will be better next fall than it has been for years.

The Buckeye Electric company, Cleveland, O., has fitted up the steamship St. Louis with 1,800 Buckeye steamship type incandescent lamps, and is now fitting up the steamship St. Paul with a similar type of lamp. The electrical equipment of the St. Louis was installed by the Electro-Dynamic company, Philadelphia, supervised by Electrical Engineer N. Pfatischer.

The Paris house of the Boudreaux Dynamo Brush company received last week the following letter from the French Navy Department: "I have the honor to inform you that in consequence of the satisfactory results obtained with your foliated brushes in the port of Brest, I have authorized by dispatch, on this date, the use of it in our five ports and the establishments of Indre and Guerigny."

Twelve or 15 years ago Dixon's graphite pipe-joint compound was known under the name of smear grease, and later was changed to pipe-joint grease. It really is not a grease, and as the name has caused some misunderstanding the Dixon company have decided to change it, and it hereafter will be known as "Dixon's graphite pipe-joint Compound." This compound, under one or the other of its several names, has been in the market for about 20 years. It is not only useful for joints, and all steam, gas and water piping, but is equally useful for smearing gaskets and flange-joints of meters, traps, and for bolts, screws, etc. In the mills, mines and factories of the Dixon company this compound has been used in preference to any other article. The president of the Water and Lighting department of Harrisburg, Pa., said: "I have long ago forbidden the use of white or red lead, or anything but your graphite compound in this department. The result is that we have no more breaking of bolts or nuts on our street mains, valves, etc., or any trouble of that kind in or about our pumping plant. I think those plumbers or steamfitters who persist in the use of white or red lead are doing so purely through ignorance, as nothing is so costly, not even carelessness."

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued July 16, 1895.*

542,617. Running Gear for Electric Railways. Bion J. Arnold, Chicago, Ill. Application filed April 13, 1891.

The combination illustrated consists of a frame carried upon trucks loosely supported at opposite ends upon wheeled axles, an electric motor thereon, speed-reducing gearing between the armature and the axle, and elastic connections permitting play of the gearing eccentrically out of normal alignment with the axle.

542,618. Telephone Relay or Repeater. Chester H. Arnold, Boston, Mass. Application filed March 16, 1895.

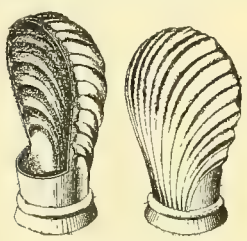
In a telephone relay or repeater system the features claimed are a compound main line circuit, a double bridge between the conductors of the main line circuit, each branch thereof containing a repeating or receiving magnet; two local repeating circuits, controlled by the two receiving magnets respectively, and induction coils, having their secondary windings in the two main line conductors respectively, one-half on either side of the bridge, and their primaries included together with variable resistance repeating transmitters in the local circuits respectively.

542,619. Telephonic Repeating Circuit and Apparatus. Chester H. Arnold, Boston, Mass. Application filed March 16, 1895.

The last claim is given: The combination in a telephone circuit repeating system, of a main telephone circuit, a local repeating circuit including a variable resistance transmitting medium, a bridge extending between the main circuit conductors, a repeating or receiving electro-magnet mounted in operative relation to the said variable resistance medium, and a repeating induction coil, having its secondary winding in two sections connected in the two main line conductors on different sides of the bridge, and its primary also in two sections, both in the local circuit, and each associated with one of the secondary sections; with two condensers included in the circuit of the bridge conductor, one on each side of the repeating electro-magnet.

542,625. Carbon for Electric Lamps. Henri F. Cabirau, Paris, France. Application filed April 11, 1895.

A compound carbon pencil for electric arc lamps, consisting of two nested together pencils, cemented to each other, and air openings between the nested pencils.



NO. 24,473.

542,640. Electric Governor. William W. Handy, Lake Roland, Md. Application filed May 1, 1895.

The arrangement illustrated comprises a dynamo, a prime motor, and mechanism for regulating the force applied to the motor, a shunt coil, and a series coil in the same circuit, and mechanism operated by the coils, and a mechanism controlled thereby to regulate the force applied to the motor.

542,657. Telephone Relay Apparatus. Wilton L. Richards, Malden, Mass. Application filed March 16, 1895.

There are two main telephone line circuits and two independent artificial lines or balancing circuits associated with the main circuits respectively, with repeating or relay electro-magnets, one for each set of circuits each magnet having one-half of its winding in the main line circuit, and one-half in the associated artificial line or balancing circuit.

542,658. Telephone Repeating Circuit and Appliances. Wilton L. Richards, Malden, Mass. Application filed March 16, 1895.

Two main telephone circuits have two alternative terminal branches extending respectively through a relay magnet and the secondary winding of an induction coil, an electro-magnetic switch for each circuit controlling the relation of the circuit to its two branches, and current-changing devices for each circuit controlling the polarized switch of the circuit.

542,662. Electric Arc Lamp. Elihu Thomson, Swampscott, and Charles E. Harthan, Lynn, Mass. Application filed June 25, 1894.

In the electric arc lamp illustrated a core for the series coil is composed of a body of subdivided magnetic material, having an insulating washer upon each end and wrapped in insulating material. There is an insulating ring over each washer and a sheathing of sheet-iron, having its ends crimped over the insulating rings and itself slotted to prevent the circulation of eddy currents, and an eye-plate secured in one end of the core between the insulating washer and the insulating ring.

542,663. Electric Measuring Instrument. Elihu Thomson, Swampscott, Mass. Application filed April 25, 1895.

A coil or conductor traversed by the current to be measured, placed in an inclined or angular position with respect to the shaft carrying the indicator, and a bar or plate of magnetizable material carried on the shaft, also at an angle with the axis, with means for bringing the indicator to zero when no current passes, comprise one of the claims for this invention.

542,667. Regulation of Continuous Current Motors. Merle J. Wightman, Scranton, Pa. Application filed April 2, 1895.

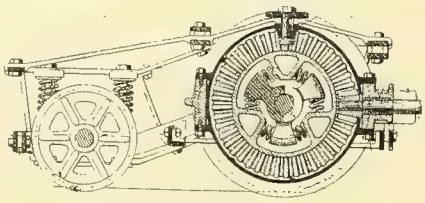
The method of operating an electric motor consists in changing the armature connections from series to multiple, then shunting part of the motor and simultaneously or successively commuting the field poles.

542,679. Coin-controlled Telephone. Charles B. Hopkins and Thomas H. Elson, Spokane, Wash. Application filed March 16, 1894.

In a coin-controlled apparatus there is a circuit-closer at the entrance to the passageway, through which the coin is adapted to pass, adapted to be actuated to close an electric circuit as the coin passes, and a circuit opener adapted to be actuated to open the circuit as the coin passes the same.

542,697. Burglar Alarm Circuit Closer. Albion A. Vanderpool, Newark, N. J. Application filed November 8, 1894.

The feature of this invention is the circuit changer for windows, in which is combined with a case having a face plate and a pin at the back thereof a lever arranged on the pin and projecting laterally at its opposite ends beyond the opposite edges of the face plate and at the opposite ends carrying rollers, a block of insulation back of the lever, and holding the same in place, and a contact spring fastened to the block and extending into the path of the lever, the latter scraping the edge of the spring longitudinally when forced to its abnormal position.



NO. 542,617.

542,732. Submarine Mine. William M. Huskisson, London, Eng. Application filed November 22, 1894.

A vessel is charged with explosive compound, and there is also a Hughes induction balance, one part of which is contained within the vessel, while another part is at a distance, an electric fuse within the vessel included in the secondary circuit of the induction balance, a current generator at a distance whose circuit is connected with the primary circuit of the induction balance, and means in connection with the secondary circuit thereof, whereby when a current passes through the secondary circuit the circuit of the current generator is switched on to the secondary circuit, and is thereby made to fire the electric fuse.

542,761. Electric Block Signal for Railroads. Angus C. Gordon, Rochester, N. Y. Application filed May 13, 1895.

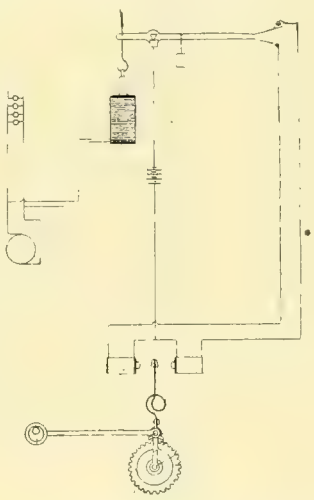
A shifting signal, a magnet, a rod between the signal and magnet provided with an armature, a motor, a connection between the motor and rod, whereby the latter is operated, and an electric circuit connected with the motor and magnet, and provided with a switch, whereby when the circuit is closed the motor first draws down the armature, then stops, while the magnet continues to hold the armature in place.

542,769. Electric Signal Apparatus. Thaddeus B. Keeler, Rahway, N. J. Application filed March 11, 1895.

Included in this arrangement are a semaphore blade and a disk mounted to move therewith, a rocking piece mounted to move concentric with the disk and semaphore, signal operating means connected with the rocking piece, and means under the control of an electric current for locking the rocking piece to and releasing it from the disk.

542,771. Means for Generating Electricity from Car Wheel Axles. Morris Moskowitz, Newark, N. J. Application filed February 27, 1895.

The combination includes a working and a lamp circuit, containing lamps or other translating devices, a main dynamo operated under varying speeds and subject to armature reversal, a pole changer and a dynamotor adapted to equalize the voltage of the dynamo in the main circuit, the main dynamo being self-exciting at a slow speed to energize the pole changer and the dynamotor and the main dynamo at a fast speed, having its fields excited and regulated independently by the dynamotor.



NO. 542,640.

542,772. Make and Break Switch. Morris Moskowitz, Newark, N. J. Application filed April 23, 1895.

There are an electro-magnet in shunt circuit, an electro-magnet in series, a combined armature bar, a commutator, and means connecting the commutator with the armature bar to establish a complete circuit through the series magnet and cut the shunt magnet out of circuit, and a shunt magnet on the armature bar in a shunt circuit.

542,773. Polarized Compound Switch. Morris Moskowitz, Newark, N. J. Application filed May 2, 1895.

In a polarized compound switch, the combination with a pair of electro-magnets, having the respective armature bars, a pair of commutators, and links for operatively connecting the armature bars with the commutators to control the same.

542,793. Advertising Illuminated Sign. Neilson Burgess, Highlands, N. J. Application filed June 14, 1894.

A box or like hollow receptacle, having recesses at the end to receive electric arc lamps, is provided with an irregular and broken reflecting surface, the electric lamps placed in the recesses in the box, and a front wall or screen provided with slits formed to the desired outline.

542,822. Microphone. Henri Carbonelle, Brussels, Belgium. Application filed October 9, 1894.

The vibrating diaphragm, the carbon button having the disks connected by the flexible tube and the filling of carbon granules, the conductors connecting with the disks, the carbon button being suspended from the vibrating diaphragm by an intermediate flexible connection.

542,833. Annunciator. John W. Olson, Chicago, Ill. Application filed November 21, 1894.

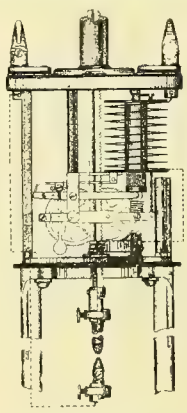
The inventor claims the combination with the magnet core of a coil provided thereon, a vertical extension being provided upon one end of said core, a straight bar of magnetic material pivoted near the middle to the upper end of said extension, said bar being adapted to lie parallel to and close against the coil, one end of said bar resting opposite an extension provided upon the opposite end of said core, and an annunciator drop normally engaged by the opposite end of said bar, the end of the bar engaging the drop being of greater weight than the opposite end, whereby an annunciator of compact structure is produced.

542,848. Electric Switch. George T. Eyanson, Philadelphia, Pa. Application filed May 10, 1895.

A blade is adapted to be engaged with and disengaged from the circuit terminals, a yoke or open frame piece connected with the blade, a pivoted operating arm extending freely through the yoke or frame piece, so as to have vertical play therein, and a spring co-acting with the arm and yoke or frame piece.

542,913. Telephonic Relay or Repeating System. Chester H. Arnold, Boston, Mass. Application filed March 16, 1895.

In an automatic telephone repeating apparatus, the combination of a compound through telephone circuit, comprising two main line sections extending from outlying stations to a repeating station, and a short central section located at the repeating station, repeating induction coils uniting the central section to the main line sections respectively, a bridge uniting the conductors of the central section, and a receiving magnet included



NO. 542,662.

therein, a local repeating circuit containing a repeating transmitter responsive to the receiving magnet, and a battery; and a repeating induction coil having a primary winding in the local circuit, and a secondary winding included in the central main line section on the two sides of the bridge respectively.

542,916. Electrical System for Signaling Between Trains. Alejandro Basanta y Baque, Madrid, Spain. Application filed January 21, 1895.

This arrangement comprises insulated conductors in sections, a magneto machine carried by each train, and means whereby said magneto machine is set in motion by the movement of the train, contacts carried by each train to make contact with the conductors, telephonic apparatus and signal bells and a switch carried by each train to throw the telephone apparatus or the signal bells to line and connections, whereby at the moment of closing the circuit between two trains going either in the same direction or in opposite directions the two trains will receive a signal at the same time and telephonic communication be established.

542,926. Electric Annunciator. William J. Clarke, Trenton, Can. Application filed February 5, 1895.

There are two batteries and their circuit wires, the return call keys, the fire alarm switch or push button, and the relays and alarm bells in the rooms, and circuit wires leading thereto.

542,928. Signaling Apparatus. Lucien S. Crandall, Parish, N. Y. Application filed February 17, 1893.

The monogrammic display frame consists of end and side bars, central, bisecting cross bars and corner extensions, the respective bars having disposed along their lengths electrically illuminable signaling devices, whereby on the one device the several letters of the alphabet or other predetermined symbols may be produced.

542,945. Electric Meter. Henry A. Rowland, Baltimore, Md. Application filed April 19, 1895.

There is the combination with a magnetic field of a non-magnetic conducting body revolubly mounted in the field, and a plurality of coils of wire mounted on the non-magnetic conducting body.

542,979. System of Electrical Distribution. Georg W. von Siemens, Berlin, Germany. Application filed April 26, 1893.

Connected with a source of energy are feeder conductors, main distributing conductors translating devices arranged in parallel series of the conductors, and devices for automatically regulating the potential of the current between a pair of the distributing conductors by the counter-electromotive force of the regulating devices.

## DESIGNS.

24,473. Electric Light Shade. Harrison D. McFaddin, East Orange, N. J. Application filed June 10, 1895.

The cut shows the design for an electric light shade.

Western Electrician.

EVERY SATURDAY.

Vol. XVII. CHICAGO, AUGUST 3, 1895. No. 5

## Waukesha-Pewaukee Electric Railway.

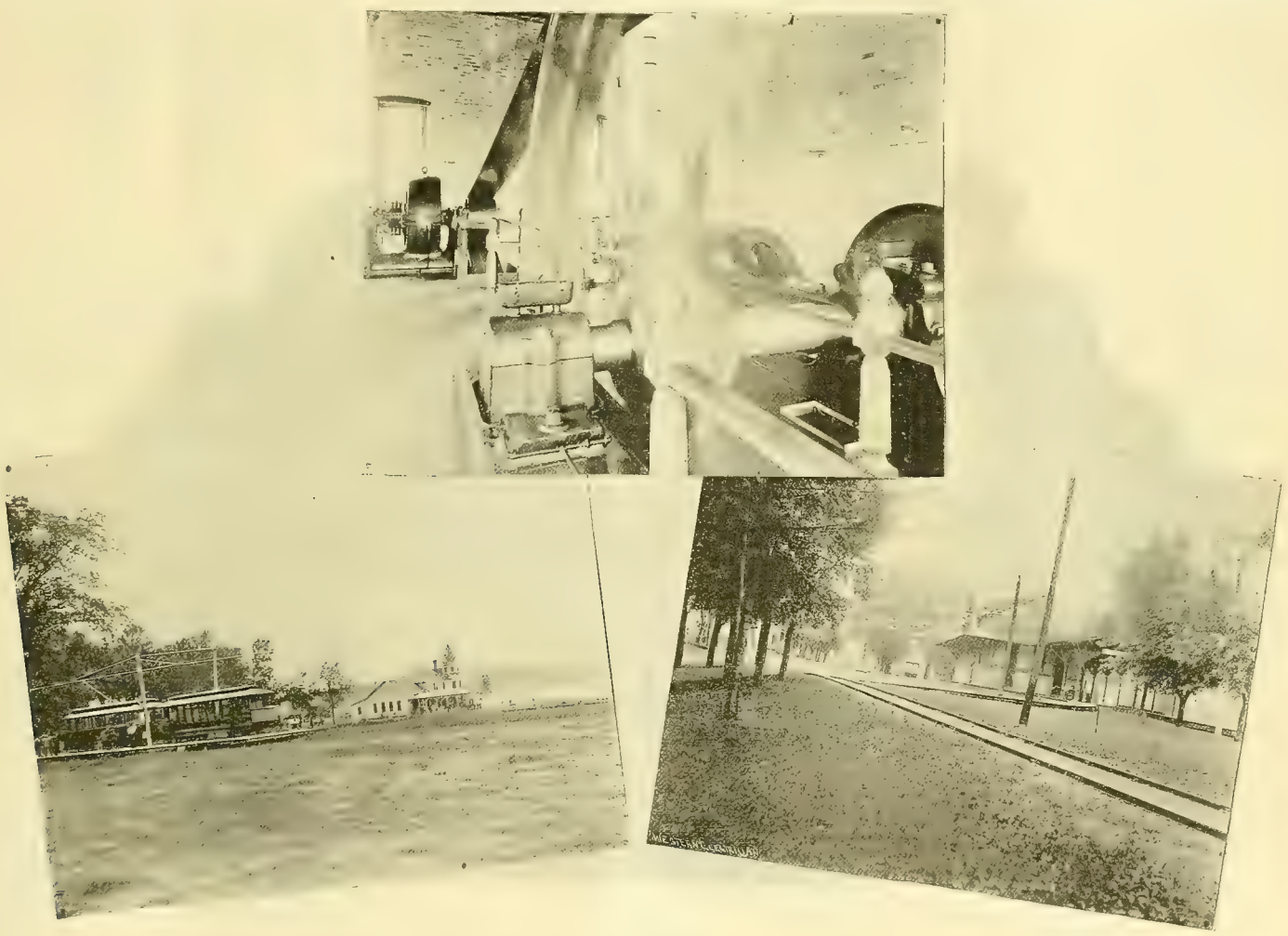
The new electric railway connecting Waukesha, Wis., with Pewaukee Lake is a good example of a well-built rural electric line approximating steam railway service in track construction and speed of trains. Waukesha is a small city 18 miles west of Milwaukee which has acquired considerable prominence as a summer resort owing to its numerous springs, noted for the purity and volume of the water. Unlike nearly every other Wisconsin resort, however, Waukesha lacks the advantages of boating and fishing due to a lakeside location. This drawback has hindered the town greatly in securing the trade of summer pleasure seekers, but has now been almost entirely obviated by the construction of the electric railway herewith illustrated. This line runs to Pewaukee Lake, an irregular body of water of considerable size which still furnishes very fair sport to the fisherman while delighting the eye of the tourist by its picturesque shores. The road is intended for summer pleasure travel. It enables the resident or visitor at Waukesha to reach the cool lake beach in 15 minutes, although a distance of six and one-quarter miles, with steep grades and sharp curves, intervenes. The road has only been open for business two months, but the results from operation already demonstrate that it will be a pronounced success. It is owned and operated by the Waukesha Beach Railway company, of which C. L. Jones is manager.

The line runs from the Chicago & Northwestern passenger station in Waukesha in a northwesterly direction to Waukesha Beach, on the southern shore of Pewaukee Lake, about 6¼ miles from Waukesha. The road was open for passengers on June 1st of this year, having been entirely built and equipped since last October, at which time the project of a road to Pewaukee Lake was first thought of.

The roadbed is well ballasted and is laid with a 60 pound steel T rails. The rails are bonded with two No. 0 copper bonds, with cross bonds at frequent intervals. The trolley wire is No. 0 hard drawn copper, fed by three No. 0000 feeders, tapped in at intervals of 10,000, 20,000 and 30,000 feet from the power station. Side poles are used entirely. There is but a single track from Waukesha to the beach, with a turnout at half the distance between. The power house is a substantial brick building, and is equipped with a 150 kilowatt Walker four-pole generator, driven by a 250 horse power Allis-Corliss engine. The Cutter Manufacturing company's switches and automatic cutouts are used on the switchboard with Weston volt and ammeters.

One feature of the road is the speed at which the cars run. The distance of 6¼ miles is made in about 15 minutes. This time, however, has been reduced to 12 minutes, making a rate of over 30 miles per hour. This is a fast run, considering the number of grades and sharp curves, which necessitates slow running for a part of the distance.

The cars, six in number, with capacity for about 75 passengers each, were built at the Pullman works and are mounted on the Brill Eureka maximum double trucks. They are equipped with two 50 horse power Walker motors, and are also equipped with Walker controllers, The entire road was built and equipped by C. E. Loss & Co. of Chicago, and the electrical apparatus was supplied through Kohler Bros. of the same city. The equipment has given entire satisfaction.



Terminus at Pewaukee Lake. Power Plant. Terminus at Waukesha

WAUKESHA-PEWAUKEE ELECTRIC RAILWAY.

## Scribner Double-carbon Arc Lamp Held to be Non-infringing.

An important decision in the double-carbon arc lamp litigation was handed down by Judge Showalter in the United States Circuit Court for the Northern District of Illinois on July 24th. The decision was on two cases, the Brush Electric company and the Western Electric company being complainant and defendant, respectively, in each. In one it was alleged that the patent granted to Charles E. Scribner on January 7, 1890, and assigned to the defendant, infringed the celebrated double-carbon arc lamp patent of Charles F. Brush, granted on September 2, 1879, while in the other case the more recent Scribner patents of August 1, 1893, were said to infringe the same Brush patent. The court decided against the Brush company in both cases, holding that the Scribner lamps did not come within the claims of the Brush patent, although the same end was achieved by means not claimed in the Brush patent. He dismissed both bills for want of equity.

This is an important victory for the Western Electric company, which was represented by Barton & Brown. The cases may be appealed to the United States Circuit Court of Appeals, but as it stands the decision removes the exclusive claim of Brush in the double-carbon lamp field, for all-night lighting. The parties to these suits have been in litigation over five years over double-carbon lamps, and the printed record before Judge Showalter reached 1,500 pages. In August, 1890, Judge Brown, now Justice Brown of the United States Supreme Court, decided at Toledo that the Scribner patent of January 7, 1890, was an infringement of the Brush patent. Judge Showalter, however, takes a different view, and holds that neither the patent of 1890 nor

those of 1893 infringe the Brush patent of 1879. The cases past decade were argued about May 1st last, and Henry A. Seymour, Offield, Towle & Linthicum and Wm. B. Bolton appeared for the complainant.

Following is the text of Judge Showalter's opinion:

In each of these causes the ground of action is an alleged infringement of patent No. 219,208, for an electric lamp or light regulator, issued September 2, 1879, to Charles F. Brush, said patent being the property of complainant company.

In cause No. 21,545 it is insisted that electric lamps made by defendant company pursuant to patent No. 418,758, issued to Charles E. Scribner, January 7, 1890, and afterward assigned to defendant company, infringe the said Brush patent.

In cause No. 22,211 it is insisted that lamps made by defendant company pursuant to patent No. 502,535 and lamps made by defendant company pursuant to patent No. 502,536, each of said last named patents having been issued to said Charles E. Scribner August 1, 1893, and afterwards assigned to said defendant company, also infringe said Brush patent.

Prior to the first of these suits, the complainant commenced a suit in the Federal Circuit Court at Toledo, Ohio, for an alleged infringement of said Brush patent by lamps made by this defendant company under said patent No. 418,758 and used or dealt in by the defendants in that suit.

It appears that this defendant assisted the defendants in that suit by paying the expenses or some part thereof, incurred therein by or on behalf of said defendants.

But this defendant was not a party to the record in the Ohio litigation. The jurisdiction of that court did not, nor could its decree in favor of complainant, rendered pending the first of the causes in this court, in any way conclude this defendant company. The records here, even that in the first of the causes, contain a mass of evidence which was not before the court of Toledo. But I do not understand complainant's counsel to insist that either of these causes can be determined on the theory of a prior adjudication. He merely insists that the opinion of the court in the Ohio case may be determinative not only of one but of both the present causes.

There are seven claims in the said Brush patent. On the contention of complainant an infringement of each of these

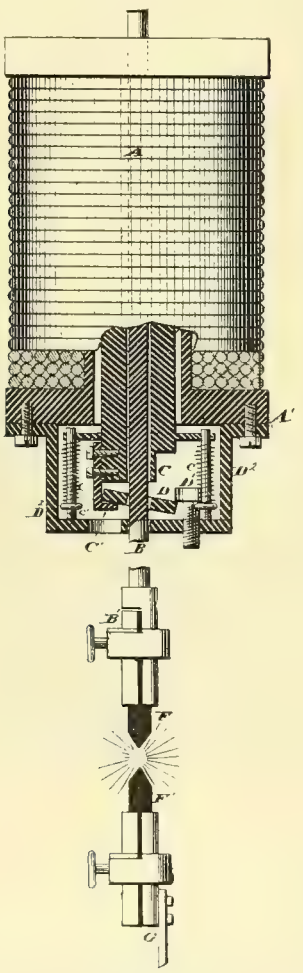



FIG. 1. SCRIBNER DOUBLE-CARBON ARC LAMP HELD TO BE NON-INFRINGING (DRAWING IN BRUSH PATENT NO. 203,411).

numbered from one to six is shown in each of the present causes. But this contention rests upon a construction of the Brush patent, extending in common to each of said claims, which is earnestly disputed by the defendant. The controversy, so far as it involves in common each of the six claims as contested in each suit, hinges upon this one point of construction.

If two carbon pencils placed so that their points touch and thus being part of an electrical circuit, be slightly parted at their points, a current will continue to flow over the open space, burning said points, and forming between them an arc of brilliant white light. This arc will persist while the current continues to flow, till, owing to the consumption of the pencil points, the distance spanned becomes so great that eth current, unable to overcome the resistance, ceases, the carbon points stop burning, and the light disappears.

If two parallel pairs of carbon pencils, with the points at each pair touching, are placed in an electrical circuit so that in case either pair were removed, the current would still pass through the other, such current will divide between the pairs. If such pairs be now separated at once and by a common and uniform movement, the arc will appear between the points of but one pair. It is not practical to make the points of the carbons impinge so that the resistances through each pair shall be mathematically equal, nor is it practical to separate the points so that the parting on one side shall be identical in time with that on the other. The reason why the arc forms between one pair only may be said to be that the other pair in fact parts first, thus throwing the entire current through the pair between which the arc forms.

While the partings may be in appearance simultaneous they are not so in reality, or if we say the partings are in fact simultaneous then the resistance being accidentally greater on one side, determines the formation of the arc on the other.

On May 7, 1878, complainant's assignor, Brush, patented a contrivance for feeding one carbon pencil toward the other so as to preserve a practically uniform distance or length of arc between the burning points till the carbon should be consumed.

In this invention the carbons were arranged in a vertical line with their points touching. The lower carbon was fastened by a plant in a holder projecting from the base of the lamp frame. The upper carbon was held in a clamp on the lower extremity of a holder which extended downward from the upper portion of the lamp frame through a tubular soft iron core of a solenoid, the helix of which was included in the main electric circuit, whereby the lamp was actuated, thence through a flattened loosely fitting ring $D$ [Fig. 1], thence through a horizontal platform or floor on which said ring rested when the lamp was not in operation. To the lower extremity of this core was attached a lifter $C'$, a projection at the lower end of which extended under one side of said ring $D$. When the current passed through the carbons the lifter engaging said ring tilted the same, so that it clamped and lifted the upper carbon rod, thus separating the carbon points so that the arc was formed. As the resistance grew less by the shortening of the carbon rods in burning, the current became less energetic and the upward pull of the lifter on the edge of the ring clamp $D$ relaxed so that the upper carbon rod was permitted to pass imperceptibly downward, whereupon the upward pull became more energetic, the increasing energy of the current causing the said ring clamp $D$ to tighten and hold the upper carbon in the new position. Thus the process went on until the upper carbon was so far consumed that the holder could descend no further, the further descent of the rod being stopped by an enlargement at its upper end, which at that period of the operation of the lamp engaged with the upper portion of the lamp frame. The space between the carbon stumps then increased without further feeding until the current could not longer overcome the resistance and the lamp ceased to burn.

On September 2, 1879, Brush secured, as before stated, the patent in suit. To his invention, as above described, he added a second pair of carbons, a second pair of carbon holders and a second movable or feeding carbon rod. Each carbon rod passed down through its ring clamp marked, the one $C$ and the other $C'$ [Fig. 2] in the new patent. The lifter, marked $D$ in the new patent, was triangular in form with a stirrup at the top, in which was fastened a lever which was to be operated by magnetic attraction. At each lower corner of said lifter $D$ was an opening formed by two short projections, one above the other, each opening enclosing the edge of its appropriate ring clamp $C$ or $C'$. The lower arm or section of one of these openings was below the plane of the corresponding part of the opposite opening, so that, when the current passed through the carbons, as lifter $D$ was pulled up, it first engaged the ring clamp of the added carbon rod, separating the added pair of carbons, and after an interval of continuous movement the ring clamp of the other carbon rod was engaged by the other corner of said lifter $D$. The two rods continued thence to move together until the lifter $D$ stopped and the arc was formed between the carbons which were last separated. The latter pair of carbons, being fed together and continuing to burn until consumed, the added pair of carbons then part and form the arc and continue to burn until consumed in manner as stated in said first patent to Brush. After the first pair of carbons have been consumed and have ceased to burn, the lamp, in parting and burning the remaining pair, is substantially identical with the invention described in said prior patent.

In 1874 one Mathias Day, acting on the observed facts above stated, that when two parallel pairs of carbons disposed in the same circuit so that the current divides between them, are separated simultaneously, an arc forms between but one pair, constructed his lamp wherein he consumed two pairs of carbons in alternate or reciprocal succession. This lamp, however, failed of commercial success because in such parallel carbons so equally and simultaneously separated the arc persists but a short time in one pair before alternating to the other.

The ideas of the Brush invention in suit were apparently these:

(1) By separating the added pair of carbons first he threw the entire current down the other pair, and thus determined that the arc should form between said other pair, or pair last separated.

(2) By separating the added pair at a greater distance apart than the other pair he avoided accidental alternation in the arc between the two pairs.

(3) By permanently holding the added pair in such separated relation the first pair could be fed together and consumed without stop.

In his specification Brush says: "My invention comprehends, broadly, any lamp or light regulator where more than one set of carbons are employed, wherein—say in a lamp having two sets of carbons—one set of carbons will separate before the other."

Again: "The operation of my device as thus far specified is as follows: When the current is not passing through the lamp, the positive and negative carbons of each set $A$ $A'$ [Fig. 2] are in actual contact. When, now, a current is passed through the lamp a magnetic attraction of the hellices $E$ will operate to raise the lifter $D$. This lifter, operating upon the clamps $C$ and $C'$, tilts them and causes them to clamp and lifts the carbon holders $B$ $B'$, and thus separate the carbons and produce the voltaic arc light, but it will be especially noticed that the lifting and separation of these carbons is not simultaneous. One pair is separated before the other, it matters not how little nor how short a time before. This separation breaks the circuit at that point, and the entire current is now passing through the unseparated pair of carbons $A'$, and now when the lifter, continuing to rise, separates these points, the voltaic arc will be established between them and the light thus produced."

As already stated, after the first pair of carbons has been

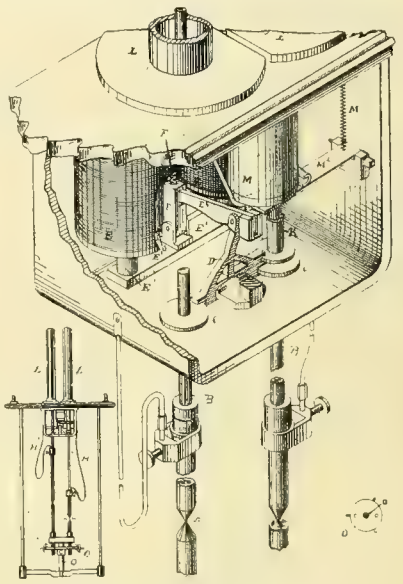


FIG. 2. SCRIBNER DOUBLE-CARBON ARC LAMP HELD TO BE NON-INFRINGING (DRAWING IN BRUSH PATENT NO. 219,208).

consumed, so that the first carbon rod holding the stump of the burned carbon ceases to feed and the added pair of carbons thereupon part and burn, the lamp of the new patent, the especial features of the new invention being now superflous, is substantially identical with the lamp of said first patent.

In the new patent—that in suit—Brush does not in the specifications describe, or in the claims refer to, the manner of burning the added pair as being a part of his new invention.

During the burning of the added pair the lamp has become substantially the invention protected by the said first patent.

The patentee says further in the specification of the patent in suit: "The lifter $D$, in the present instance, is so formed that when it is raised it shall not operate upon the clamps $C$ $C'$ simultaneously, but shall lift first one and then the other (preferably the clamp $C$ first and $C$ second, for reasons which will hereafter appear). This function of dissimultaneous action upon the carbons or their holders, whereby one set of carbons shall be separated in advance of the other, constitutes the principal and most important feature of my present invention."

In his drawings and in describing the mechanism and the action thereof of the patent in suit, Brush shows only two pairs of carbons, but in other places in his specifications and in his claims quoted below, he speaks of two or more pairs of carbons. It will be seen that by affixing additional arms to the lifter $D$, additional clamp rings holding additional carbon rods and pairs of carbons might be operated. In such case the clamp rings would be engaged in rapid succession by the upward movement of the lifter $D$, and the arc would form as before, between the pair of carbons last separated. So that in such case, as Brush puts it in his claims, the separations would take place "dissimultaneously or successively." The word "successively" is here synonymous with "dissimultaneously," the latter term having been coined to imply more definitely the unity of movement which characterizes the separations, whether between the members of two pairs or between the members of more pairs than two. I have said that the clutch lever $D$ might be made to effect separations between the members of more than two pairs, but for the purpose of thinking and reasoning about the case, we do not go astray if we think of one pair to be last separated and then burned, and of one added pair to be more widely separated and thereupon maintained in such separated relation pending the burning of the other pair. The claims in controversy are as follows:

"1. In an electric lamp two or more pairs or sets of carbons in combination with mechanism constructed to separate said pairs dissimultaneously or successively substantially as and for the purpose specified.

"2. In an electric lamp two or more pairs or sets of carbons in combination with mechanism constructed to separate said pairs dissimultaneously or successively and establish the electric lights between the members of but one pair (to-wit, the pair last separated) while the members of the remaining pair or pairs are maintained in a separate relation, substantially as shown.

"3. In an electric lamp having more than one pair or set of carbons the combination, with said carbon sets or pairs of mechanism constructed to impart to them independent and dissimultaneous separating and feeding movements, whereby the electric light will be established between the members of but one of said pairs or sets at a time, while the members of the remaining pair or pairs are maintained in a separate relation, substantially as shown.

"4. In a single electric lamp, two or more pairs or sets of carbons, all placed in circuit, so that when their members are in contact the current may pass freely through all said pairs alike, in combination with mechanism constructed to separate said pairs dissimultaneously or successively, substantially as and for the purpose shown.

"5. In an electric lamp wherein more than one set or pair of carbons are employed the lifter *D* or its equivalent, moved by any suitable means, and constructed to act upon said carbons or carbon-holders dissimultaneously or successively, substantially as and for the purpose shown.

"6. In an electric lamp wherein more than one pair or set of carbons are employed, a clamp *C* or its equivalent, for each said pair or set, said clamp *C* adapted to grasp and move said carbons or carbon-holders dissimultaneously or successively, substantially as and for the purpose shown."

The observable interval between the point of time at which the separation between the added pair of carbons takes place and the point of time at which the separation of the other pair takes place, the purpose being to determine the arc between the pair last separated, is the dissimultaneousness found in each of said six claims.

With all respect for the learned writer of the opinion in the Toledo case and the learned counsel for complainant, the formula of words "dissimultaneous arc-forming separation" does not carry any definite meaning. The adjectives simultaneous or dissimultaneous are words of comparison. The former means that two or more occurrences or happenings are identical in time, the latter that they are successive—that is to say, with an interval between each two in succession. The arc-forming separation which takes place between the first pair of carbons to burn and the arc-forming separation which takes place several hours later between the added pair of carbons are certainly successive, and loosely speaking, dissimultaneous, but these separations lack the unity or continuity of movement implied in the term dissimultaneous when used in this patent. As already said, Brush coined the word "dissimultaneous" to express the momentary but observable interval the slight but noticeable non-coincidence in time—between the separation of the added pair of carbons and the separation of the other pair in a unitary and continuous movement due to mechanism as invented by him and described in the patent in suit, in contrast with an apparently simultaneous separation due to any mechanism appropriate for the latter purpose.

The patentee said further in his specification: "I do not in any degree limit myself to any specific method or mechanism for lifting, moving or separating the carbon points or their holders, so long as the peculiar functions and results hereinafter to be specified shall be accomplished."

The specifications and claims were evidently prepared with the idea that the mode of movement, to-wit, the rapid, successive and continuous separation between the pairs of carbons terminating in the arc between the pair last separated, could be secured to Brush, regardless of the mechanism by which this mode of movement should be produced. In Brush Electric company vs. the Fort Wayne Electric Light company, Judge Gresham held, answering the contention that the first, second, third and fourth claims were for functions or results, and hence void, that mechanism such as described in the drawings and specifications or a substantial equivalent was an essential element in each of said claims. I am not called on to determine as between these constructions, but the conclusion reached apparently in the Toledo case, that no one of these claims contains the element of dissimultaneous or successive separations between the members of each pair of carbons for the purpose of forming the arc between the pair last separated, seems to me unsound.

The patentee says: "In the lamp as shown in the drawings the support *K* [Fig. 2] is in the form of a tube surrounding the carbon holder *B*, and this support *K* is made of such a length that when the carbons *A'* shall have been sufficiently consumed a head upon the carbon holder *B* will rest upon the top of the support *K*, whereby the weight of the carbon holder *B* and its support *K* shall at all times and under any circumstances be supported by the lifter *D*."

In other words, and without going again over the mechanism, the lamp is constructed so that the carbons *A* shall first burn. By reason of the support *K* being carried on the upper carbon holder of the first pair of carbons to burn, and of the greater distance between the two carbons of the added pair, said added pair could not be burned first.

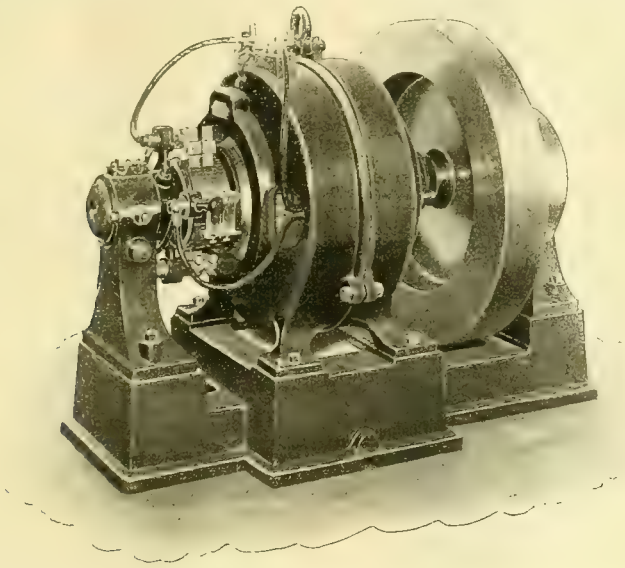
It is, in other words, the characteristic feature of this lamp, the very purpose signified by its construction, that the position of the first arc shall be determined, before lighting, as between the two pairs of carbons.

Yet, in the opinion of the Toledo case, this is declared to be "a wholly immaterial and useless feature."

Even if it were, in fact, immaterial which pair of carbons burned first—supposing it to be true that if the carbons were separated simultaneously instead of dissimultaneously the lamp would still operate—the fact remains that the patentee took from the government claims in which the dissimultaneous separations are the special feature. Moreover, the feature of dissimultaneous arc-forming separations—referring here to the interval of hours between the arc-forming separation of the first pair to burn, and the arc-forming separation between the added pair—is not in any one of the claims. In order to make out a case of infringement the former element must be gotten out of and the latter must be gotten into each claim. This in my judgment cannot be done. The lamps made under patent No. 418,758 do not contain mechanism constructed to cause the dissimultaneous initial separations of the carbons, nor do the lamps made under patent No. 502,535, nor do the lamps made under patent 502,536. I hold, therefore, that no infringement is made out in either suit. The order will be in each case that the bill be dismissed for want of equity.

## Lundell Generators for Gas Engine Service.

Evidence of the progress that has been made in the application of gas engines to the operation of electric lighting plants, especially in the smaller installations, is found in the fact that manufacturers of electrical apparatus are devoting much attention to the designing and perfecting of this class of work. In the accompanying cut is shown a modification of the Lundell generator as constructed for service in isolated lighting when the motive power is furnished by a gas engine.



LUNDELL GENERATORS FOR GAS ENGINE SERVICE.

In order to provide for absolutely uniform electromotive force, or, in other words, uniform incandescence of electric lamps in such a plant, this special generator has been designed which carries, in addition to the belt pulley, a flywheel of heavy rim weight. In this flywheel is stored up sufficient energy to compensate for the slight inherent irregularities in the speed of the gas engine. It will be observed that extra care has been taken in furnishing substantial pedestals, heavy shaft, and modern self-aligning and self-oiling bearings. The efficiency of the dynamos is from 86 per cent. for the small machines to 95 per cent. for the largest machines. The regulation of these machines is automatic, giving uniform voltage under wide variations of load.

## Telephone Rate War in Indiana.

A telephone war between the Central Union and Frankfort Telephone companies was begun at Frankfort, Ind., on July 23d, by the Central announcing a cut of $1 a month on its rates, and the Frankfort company promptly reducing its rate. The Central, before the new company was organized, charged $3 for residences and $4 for offices, but six weeks ago cut its rate to $2 and $3. Its new rate is $1 and $2. The new company has been charging $1.25 and $2.25. Free service, the Central folks threaten, will be the outcome of the war.

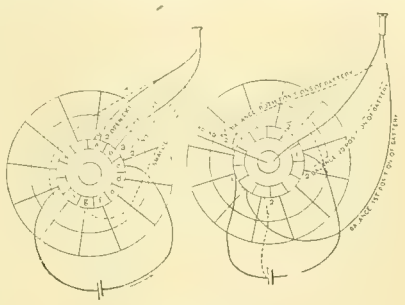
## Electric Plant in Rothschild's, Chicago.

It was erroneously announced in the article describing the plant of the Rothschild department store, Chicago, published in the WESTERN ELECTRICIAN of May 25th, that two 125 light Brush dynamos would be installed in addition to the present equipment. The McEwen Manufacturing company of Ridgway, Pa., supplied the generating apparatus and the Rothschild company is very well pleased with its operation. The Brush company supplied 400 arc lamps and received an order for 600 more.

## Location of Grounds in Armatures, Fields, Etc.

BY CLARENCE F. GILBERT.

This paper presents no novel scientific principles. The methods herein described are but simple adaptations of the principle of the Wheatstone bridge. If the work can be performed in a very quiet room, two or three cells of battery, a telephone receiver and connecting wires comprise the necessary apparatus. In some cases two "table binding posts" and a foot or two of No. 18 or No. 20 bright iron wire will be a convenient addition. Where noise will not permit the use of a telephone, a dead-beat reflecting galvanometer, a milli-voltmeter, or some other form of delicate and rapid working visual indicator must be used instead. If an armature is to be tested without removing it from the machine, connection with the battery may be made through the brushes, first making certain that the short-circuiting switch is opened, if dealing with an arc machine. The points of connection with the battery need not be diametrically opposite, and may be made by the wires being firmly pressed against the commutator by an assistant, if more convenient.

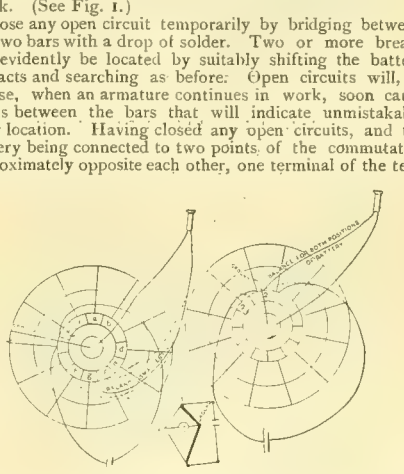


FIGS. 1 AND 2. LOCATION OF GROUNDS IN ARMATURES, FIELDS, ETC.

Good electrical contact between metallic surfaces can better be secured by cleaning the same thoroughly with kerosene, which removes foreign matter, and is so fluid that it will in no way interfere with perfect contact, when moderate pressure is applied. Especially when making measurement of resistance of armature sections, it is even advisable to have the surface of the commutator quite wet with kerosene during the operation, as this avoids trouble from grease or dirt which might get on the surface from handling, subsequent to cleaning, and it also prevents the contact points becoming oxidized by any sparks which may occur at the moment of breaking contact. True the oil is an insulator, but we use it in this case as a detergent simply.

Returning to the armature: connection being made between battery and commutator, first determine whether the armature circuit is complete throughout. If the circuit is complete, a click will be heard in the telephone when the two terminals of the same are brought in contact with any two contiguous bars of the commutator, or when contact is broken. If an open circuit exists on either side of the circuit, of course no sound will be heard in the telephone when used on that side, except when connection is made or broken by it between the bars lying on opposite sides of the break. (See Fig. 1.)

Close any open circuit temporarily by bridging between the two bars with a drop of solder. Two or more breaks can evidently be located by suitably shifting the battery contacts and searching as before. Open circuits will, of course, when an armature continues in work, soon cause burns between the bars that will indicate unmistakably their location. Having closed any open circuits, and the battery being connected to two points of the commutator, approximately opposite each other, one terminal of the telephone is connected to the armature shaft, or frame of the machine, and the other terminal is drawn completely around over the surface of the commutator, while the telephone is held to the ear. If only one ground exists, two balancing points, or points giving the least noise in the telephone, will be found.



FIGS. 3 AND 4. LOCATION OF GROUNDS IN ARMATURES, FIELDS, ETC.

In an armature of ordinary construction, one of the points so found will be on the bar nearest the real ground, while the other balancing point bears what might be termed a "bridge relation" to the first, being at practically the same potential; the armature itself forming in reality a veritable Wheatstone bridge. Now, shift the points of battery contact a few bars either way, and the true ground, if but one exists, will be indicated in precisely the same position as before, while the other balancing point will shift every time the battery contacts are shifted. (See Fig. 2.)

If two grounds exist, two balancing points will be found, as before, but both points will shift more or less when the

1 Read at the twelfth general meeting of the American Institute of Electrical Engineers, Niagara Falls, N. Y., June 25, 1895.

battery contacts are shifted, provided the grounds lie on opposite sides of the same battery contact. This case will be considered later.

In the case of one ground, having determined its location approximately, fix it as closely as may be by making and breaking contact with the telephone terminal on each of the more quiet bars, separately, until, by comparison, the two giving the faintest clicks are determined. If your hearing has served you correctly, these two bars lie nearest the trouble, the fainter one being the nearer. Prove the non-existence of a second ground by placing one of the battery contacts on the first bar to the right of the apparently permanent balancing point just found, and then on the first bar to the left of said point, the other contact being nearly diametrically opposite. This balancing point should still remain unchanged if no other ground exists.

The next step is to connect the battery to these two bars just fixed upon as lying nearest the trouble. The armature still forms a "bridge," the portion included between the two contiguous bars to which the battery is now connected forming the one side, and the remainder of the armature the other side. (See Fig. 3.)

One of the telephone terminals is now connected to the shaft as before, and the other terminal again drawn around the commutator. If the balancing point is found, say, one-sixth to one-half the long way around from one battery contact to the other (these contacts being on two contiguous bars), the trouble lies in the coil between those two bars, and the point of trouble divides the coil in the same ratio as the balancing point divides the remainder of the armature, the ground and the balancing point being respectively nearest the same battery contact. If the balancing point falls on the same bar as one of the battery contacts, the ground is located on that bar or on the lead between it and the armature, provided the balancing point is found to be upon the same bar when the battery contacts are both shifted one bar to the right or left of their original position. (See Fig. 4.)

If the balancing point appears to be found within three or four bars from one of the contacts, the precaution should be taken to test its correctness by moving both battery contacts one bar toward the balancing point. If the trouble was between the battery contacts when in their previous position, this shifting of the contacts will now throw the balancing point clear around onto the contact which was, in the previous position, farthest away from the balancing point. If, on the contrary, the balancing point remains unmoved by this shifting of the battery contacts, it shows that this balancing point is the point nearest the real ground, and that the ear was deceived in its first supposed approximation, which, with due care, however, is not likely to occur.

If such error has been made, the new point, as indicated, together with first the bar on one side of it, and then on the other, must be tried as points of battery contact; or, much better, make a new start with the contacts nearly at opposite sides of the commutator and proceed as before. A single 20,000 ohm ground on a one ohm armature should be located accurately in not over three minutes, in a quiet room. Higher resistance grounds require more battery and more care. Armatures of very low resistance also offer greater difficulty.

Where two grounds are found to exist, as indicated by the change of location of both balancing points, under the conditions before stated, when the battery contacts are shifted, the following mode of procedure will answer the purpose well, and is simple. Fix the battery contacts at any two points of the commutator nearly opposite each other, preferably at points to be determined by trial, that will cause the balancing points to fall nearly diametrically opposite to each other, and determine and mark the two balancing points, as then shown. Now place the battery contacts on the balancing points just found. If only one ground exists, the two balancing points and one battery contact will all be coincident in one point. If two grounds exist, both balancing points will be shifted from their former position. Open the armature circuit by unsoldering one of the ends of a coil connecting with the lead of the bar that is marked in the first part of this test, as one of the balancing points. Place one of the battery contacts on the armature shaft, and the other on the marked balancing point that is farthest from the point where the circuit has been opened. Next place one telephone terminal on the first bar to the right of the opened wire, and draw the other terminal from the same point, toward the right, over the surface of the commutator. The telephone will be absolutely silent until the moving terminal has just passed the ground nearest to it, and strikes the first bar beyond the same, when it will click. This ground lies in the coil between this first bar giving a click and the one passed just previously, or else in the said previous bar.

The other ground is obviously to be located in a similar manner, by placing one telephone terminal on the bar just to the left of the open wire, and from that point searching toward the left with the other terminal. Only in cases where one ground is of very low and one of very high resistance will any difficulty be experienced in locating both accurately before either is removed.

The coils thus indicated may have their terminals unsoldered, when it can be readily ascertained with each whether the ground be in the coil or in the bar just preceding it.

If scientifically inclined, or if otherwise preferable, the circuit may be opened at a point somewhere midway between the two indicated coils instead of disconnecting those coils, and the exact location of each ground determined as follows: Take a piece of "broom wire" about 18 inches long, new and clean, screw the ends firmly into two clean, brass table binding-posts, and into the other holes of the same posts screw the battery terminals. Have an assistant press the corners of the bases of the binding posts into very firm contact with the two bars that lie at the ends of the indicated coil, observing the directions previously given for securing clean contact. Place one telephone terminal in contact with the shaft, and with the other find the the balancing point on the wire. This point will indicate the relative position of the ground in the coil or commutator bar, as the case may be. If more than two grounds were suspected, the two lying the farthest apart would be approximately located by the first part of the two ground process, and if these coils were not disconnected before proceeding farther, it would be well to make two openings in the circuit, close to and lying between these outer grounds, then locate definitely these two extreme grounds, and proceed with the remaining section somewhat as with a complete armature, except that you would commence by connecting the battery to the terminals of this section, and would then bridge the telephone from the shaft to the different portions of the section, and would complete the process by applying the remainder of the two-ground test.

In dealing with a cross-connected gramme ring, an obvious change would be made in the points of application of the battery, and as many points of apparent trouble would be indicated as there were series of cross-connections.

After location of these points it would be necessary to use the auxiliary wire loop, as before described, between these points, to determine which is nearest the trouble. This fact being determined, it would in case of a single ground (indicated by the permanency of the balancing point) become necessary to remove the cross-connections from two bars before proceeding farther. The auxiliary wire loop would properly be used to complete the process.

The ordinary "closed coil" ring or drum armatures are types to which these methods are directly applicable.

The sections of open coil armatures would receive the same treatment as field coils.

Familiarity with any special forms of armature will doubtless suggest to the ingenious mind modifications of these methods suited to those forms, but it would be improper to attempt here to deal with specialties whose names are legion.

Where wet grounds exist it will always be better, when practicable, to dry them out before making the final test, as certain sections may show faults which will not be permanent. Wet grounds will of course give a click in the telephone when bridged from the commutator to the shaft when no battery is attached, owing to galvanic action of the water on the copper winding and the iron core.

Whenever necessary to deal with wet grounds in testing, it is better to make at least four tests, reversing the battery after each test, and taking the mean of the four determinations.

Field coils, also any wires of uniform cross-section, the extremities of which are accessible and within a reasonable distance of each other, can of course be easily tested for grounds by soldering or firmly clamping a bare wire of suitable size between the extremities of the conductor to be tested, applying a battery to the junctions, and bridging with a telephone between the bare wire and the object upon which the conductor is grounded. This will give only the location of a single ground, or the "resultant" of two grounds. A "T.-H." rheostat should have the battery connected to the two extremities, and the point of apparent ground determined by bridging with a telephone between the frame and the several contact plates. Then apply the battery to the frame and point of apparent ground, connect one terminal of the telephone with each extremity successively, and search from it toward the center with the other terminal, as in the case of searching for two grounds in an armature.

In determining the location of grounds that are of very low resistance, a good induction coil similar to that used in the Blake transmitter may be used with advantage in connection with the telephone receiver. The receiver is placed in circuit with the secondary of the coil, and the "bridging" is done with the primary. With high resistance grounds the best results are obtained by using the receiver only.

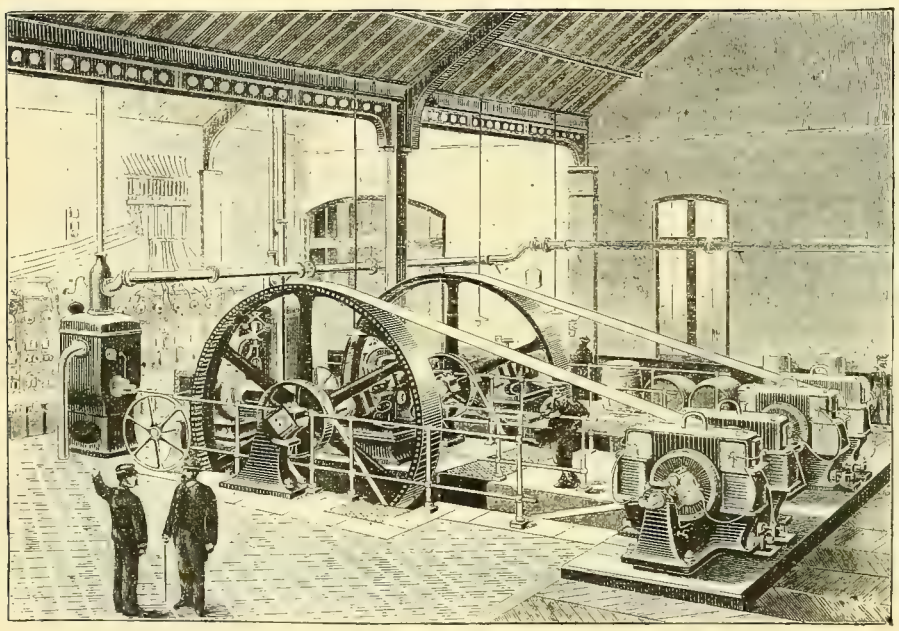


FIG. 1. EXTENSION OF THE SCEAUX RAILWAY.—INTERIOR VIEW OF CENTRAL POWER HOUSE.

## Extension of the Sceaux Railway.

Sceaux is a suburb south of Paris, which has heretofore been connected by rail with the city, with a terminal well in the south of the capital. Some particulars of the extension, and the electrical equipment especially, may be of interest. The electrical energy is made available in several directions, as will be seen further on. There still remains upon the line the coke-burning locomotives, which have been provided with special forms of condensers and smoke preventers to do away with accumulations of smoke and steam in the underground system.

The distribution of electric energy is made by a grand central power house, which transfers this to three sub-central stations, the Denfert, the Port Royal and the Luxembourg passenger stations. At each of these points a further division of current is made by means of switchboards. The distance between extreme points is 3.2 kilometers. Continuous current on the three-wire system, with a difference of 220 volts potential, is used. Arc lamps are mounted in series in groups of four, and incandescents in groups of two. There are 96 of the former and 500 of the latter.

The mechanical applications of current consist of a turning bridge at the Montrouge depot, two elevators at Montrouge, two at Denfert, and three elevators, two turntables, an exhaust pump and a ventilator at the Luxembourg depot.

Fig. 1 shows the grand central power house, which is situated in the boulevard Saint Jacques, at the side of the Denfert station. Two Roser boilers, with 90 square meters of surface, are run at a pressure of 12 kilometers per square centimeter. The engine room contains two horizontal condensing engines of 120 horse power, with a speed of 85 revolutions. These are each belted to two Sautter-Harlé dynamos on the same shaft, which are speeded to 420 revolutions, having a difference of potential of 270 volts, and an output of 160 amperes. These two generators are coupled up for the three-wire system.

The position of the station directly over the catacombs prevented the digging of wells for supplying the engines with water for condensation. The price of public water was deemed excessive, and a direct exhaust seemed barred by the wasteful results entailed. By adopting the Chaligny process of refrigeration an economical use of the public water was made possible. This process consists of a sheet-iron tank placed over a cistern walled in masonry. At the bottom of this is found a nozzle ending at a ventilator actuated mechanically. The tank contains obstructions, such as partitions, bundles of rods, etc., a sponge filter and a coke filter for removing the greasy matter and other impurities. The hot water coming from the condenser is raised by the air pump to the superior part of the refrigerator and falls in a series of drops, which pass over the obstructions and through the breeze of cool air from the ventilator. But little is lost by evaporation. The expense for water, which can thus be used again and again, is brought to a minimum.

The dynamo circuits are brought to the switchboard shown at the left of Fig. 2. Briefly, this comprises the voltmeters, ammeters, automatic circuit breakers, etc. On the floor are the rheostats, connected so that it is possible to manipulate them separately or together by means of the wheel levers at the center. On the right of the board are the three distribution connections leading to the three sub-stations, with their apparatus. Indicators of potential dif-

ferences light red or green lamps and ring bells when extremes are reached.

The installation comprises two batteries of 122 accumulators, Tudor pattern, each of a capacity of 240 ampere hours. One of these is at Denfert, the other at the Luxembourg. The accumulators are charged at these two places by boosters or continuous current rotary transformers on branches from the general circuit. These accumulators are of immense value for the distribution of power by the elevator motors and turntables, and for illumination during the resting of the dynamos.

The underground wires are naked, on insulators of glass or porcelain; those in the depots are of insulated cable, on knobs under the walks.

The distribution is complete but simple. All the circuits

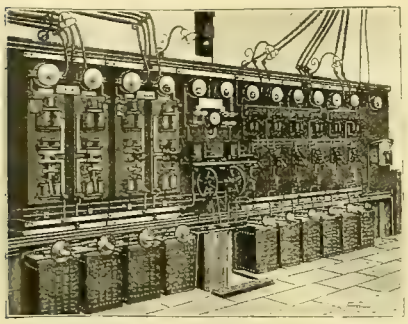


FIG. 2. EXTENSION OF THE SCEAUX RAILWAY.—VIEW OF SWITCHBOARD.

can be lighted or extinguished from the centers. The duration of illumination is about 20 hours per day. The recarboning of the lamps is done during the day, a short-circuit switch being thrown for the purpose. The other three lamps are for the time being a little brighter, but no other inconvenience is experienced.

At the Luxembourg station a ventilator and a pump are controlled by motors directly on the distribution branch. Fig. 3 shows the first of these and the 15 horse power motor running at a speed of 260 revolutions. This moves 180,000 cubic meters of air per hour at 70 revolutions. It draws the air from the subterranean passages, which is supplied by fresh air at various points along the road, and furnishes draught for the chimney of the station of the Luxembourg. The electric pump disposes of the drainage from a neighboring sinkhole. The other apparatus, elevators, turntables and bridge are moved by accumulator current. The absorption of current is so excessive, the operations are so constantly repeated, that batteries here are indispensable as aids to the direct current work. The turntables are actuated by drum and chain, as shown in Fig. 4. Similarly the turning bridge at Montrouge is moved. The turntable at the Luxembourg station is operated an average of 60 times in the 24 hours. An endless screw reduces the speed of the motor as an intermediary between it and the drum in Fig. 4.

An official test shows that on the 17th of May, for the 24 hours' run, there was burned 1,656 kilogrammes of coal, producing a total energy of 986,509 kilowatt hours at the center of utilization, a cost of 1 kilogramme of coal for 596 watt hours' efficiency. It only now remains to substitute electrical traction for steam, and the Sceaux railway should be a grand success from the electric standpoint. The illustrations are from *La Nature*.

## Executions Under the New York Law.

An interesting and highly sensational interview with Dr. Peter J. Gibbons of Syracuse has been published in the Rochester *Democrat and Chronicle*, in which the physician made two important statements regarding the execution of murderers under the present law which will doubtless lead to an investigation.

I was in Auburn prison when they killed the negro Johnson. This is a chapter which has been kept secret long enough. After the current had been applied to Johnson I was allowed to apply the simple means of artificial respiration and did so. It was not very long before Johnson gave a gasp and showed unmistakable evidence of returning consciousness. The warden intervened and prevented the further prosecution of the attempt, and of course the symptoms of returning life ceased. A little later they performed the autopsy on Johnson. It was agreed among those present that the facts should remain one of the secrets of the death chamber. They might as well be known now, and there they are.

About two months before Johnson was killed they experimented on another negro named Taylor. You will remember that in Taylor's case it was announced that the armature of the dynamo burned out and that it was necessary to obtain current from the city lighting plant to complete the operation. Such was not the case. The armature burned out, to be sure, after the current had been applied fully, but when they applied the current the second time, fifty-three minutes later, they applied it to a dead man. Taylor came to himself sufficiently to move and talk and walk. Deadly drugs were administered to him and he was killed by those drugs, and, as I say, when the borrowed current was applied it was applied to a corpse, made such by the administering of deadly drugs. There is another secret of the electric chamber.

A press dispatch from Auburn reports Warden Stout as saying:

Dr. Gibbons had no more to do with Johnson's electrocution than did any other physician present. He listened for heart beats the same as the other physicians after the current had been turned off, and could distinguish none. He made no statement to the contrary when the man was declared dead. He was present at the autopsy also, but at no time by his own or other method did he attempt resuscitation. I certainly could not have allowed i any way.

Just before the electrocution of "Dink" Wilson, Dr. Gibbons wrote to me requesting that he be allowed to try his apparatus after the electrocution. I had no right to allow him to do as he requested, but I did offer him an opportunity to bring his apparatus here and test it and demonstrate its worth or otherwise by trying it on a calf through whose body we would pass the current. He declined to do so.

His statement that drugs killed Taylor is absolutely false, as the physicians who were present at that electrocution will tell you. Gibbons was not present, and his knowledge of the affair is limited to hearsay. It will be remembered that at the Taylor electrocution the apparatus broke and it was necessary to remove the man from the chair while repairs were being made. The physicians kept the man unconscious by the use of chloroform, but when he was placed in the chair the second time pulse beats were very distinct.

Warden Stout's statements are corroborated by Dr. Conant Sawyer, the prison physician, and Drs. M. P. Conway, Philip Conboy and Francis E. O'Brien of Auburn. Dr. Sawyer, according to the press report, declares that at the Johnson autopsy some one jokingly suggested that the time and place were good for a test of Gibbons' apparatus, but the Syracusan said that he was satisfied that the electrocution was a success.

## Economies in Small Central Stations.

By W. M. Stine.

Invariably this subject, in one phase or other, appears regularly on the programme of each electric light conven-

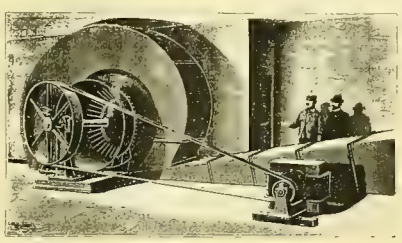


FIG. 3. EXTENSION OF THE SCEAUX RAILWAY.—ELECTRIC VENTILATING FAN AT THE LUXEMBOURG STATION.

tion. Though of such persistent reappearance, it is always discussed with unabated interest. From the very nature of the case, this condition must continue to obtain, for broadened experience will but indicate new economies.

The present article seeks to deal with some phases of the question, which have either been wholly ignored thus far, or only casually alluded to in conventions, on account of the personal nature of the discussion.

The small central stations throughout the country have proved to be often unsuccessful commercial ventures. Large stations have shown better results. One potent reason for this state of affairs is that less intelligence has been exercised in the installation and operation of the small plants. Having made such a serious charge, it is incumbent to show substantial arguments to support such a conclusion.

*The Installation.*—Many small plants have been installed contrary to some of the well established principles of good engineering. They contain more or less that is radically wrong. It is not the purpose of this article to go into detail at this point and show the losses resulting from poor adaptation of the plant to the needs of the town, to mistakes in the steam plant, the generating apparatus or the transmission. All such details have been frequently expounded. The exasperating result is that the plant does not pay. Where shall the blame be attached? The projectors of the plant knew almost nothing of electricity. They went to neighboring towns, where plants already existed, and were instructed by those knowing little more than themselves. Then negotiations were begun with agents representing various equipment and electrical manufacturing companies, with representatives of boiler and engine makers. All this is in keeping with usual transactions, but it is to be noted that engineering details have been entrusted to this class of persons. After more or less severe competition, and often a great deal of "junketing," the contract was finally let. It matters little whether it was given to the lowest bidder or not. The persons receiving it were incompetent to plan a thoroughly economical plant, and too greatly bound to their particular company interests to install a plant on the basis of the best possible practice and to adjust it carefully to the needs of the community. However successful agents may be from the commercial standpoint, as a rule they are neither competent nor trustworthy for advising engineers. Little more can be said in favor of the experts the various companies send out. They are men of too limited training and of but little experience outside of their own line of apparatus. Agents and often experts as well are more prized by their companies for commercial ability than thorough engineering experience. They are severely "practical" men.

No large plant is so installed. This is given into the hands of one or more competent electrical engineers, men who combine experience with more or less knowledge of the principles governing such work. Whether the plant be large or small, it should be planned by a competent engineer, who should be selected on account of his ability, and cheerfully paid a reasonable sum for his services. The economies in the installation alone are usually sufficient to more than pay the electrical engineer's services, not to mention the resulting economies of operation.

These remarks apply now, perhaps, more forcibly to enlargements of existing plants than to the installation of new ones, for the reason that there is more of the former than the latter taking place. It is certainly not only good business policy but common sense procedure, to have the enlargement planned by a competent engineer.

*Operation.*—Some few plants make no money because they pay interest on watered stock; more make none because they pay salaries on watered brain activity. The best argument that can be here advanced is to state an actual case. The name of the town and its location shall be blank, but the case has an actual existence. The plant is exclusively an arc light station, having two dynamos furnishing about 70 arcs. The dynamos are belted to a 70 horse power engine. The boiler plant contains one 80 horse power unit. More than half the lamps are used for street lighting; the remainder are commercial. The plant is run until midnight only. The interest-bearing capitalization is $20,000. The employes are a superintendent and secretary, an electrician and a trimmer; these receive salaries of $1,200, $700 and $300 respectively. Waiving the question of interest on watered stock, this plant would yield a handsome revenue if the salary paid the superintendent (?) went into the dividends instead of the pocket of the individual.

In this case a salary of $1,000 to $1,200 would secure the services of a competent electrician. Such a one would institute economies from the coal pile to the lamp carbons, and these would doubtless amount to several hundred dollars. The electrician, after taking into account the time of running and repair of the plant, would still have sufficient left to perform all the duties of superintendent and general manager. Such a readjustment would not only insure economy in operating expenses and better care of the machinery, but would add $700 salary savings to the dividends. It is all well enough to attempt to economize at the coal pile and elsewhere in operating, but such savings are of but little effect in increased dividends when the plant is burdened with cheap labor and useless salaries. By the time the divi-

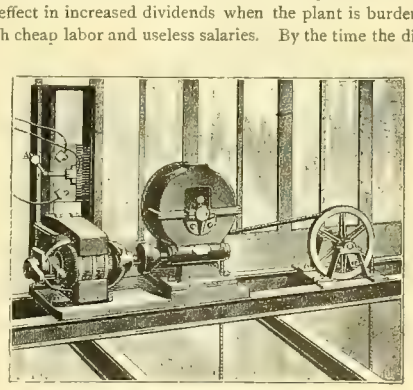


FIG. 4. EXTENSION OF THE SCEAUX RAILWAY.—ELECTRIC ELEVATOR APPARATUS.

dends have "tipped" imaginary services, they are too depleted to pay respects to the interest on the stock.

However important it is that a plant should be installed by a competent electrical engineer, it is no less important that it be operated by an intelligent and capable electrician. It does not pay to employ a mere engine runner or dynamo tender. The salaries at present paid to electricians by central stations are much too low. They are discouraging excellent men from entering the field, and offer no inducement to those so engaged to master these subjects. The business of electric lighting is falling into bad repute in many places, and we believe these causes are some of the most potent in bringing about this deplorable result.

A new company is to build an electric railway to connect South Freeport and Cedarville, Ill.

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CIRCULATION, 16,630.

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ONE of the papers read and discussed at the Chicago convention of the Northwestern Electrical association was by J. S. Stephens and had for its subject "Central Station Economies." The paper and discussion are presented on another page in this issue and they will doubtless receive consideration from practical central station men. The subject is one that cannot be too carefully considered. Prof. Stine of the Armour Institute presents some valuable ideas in his article on the same subject, which will be found elsewhere in this issue. It is a topic in which stockholders and managers are equally interested and it is of vital importance to all.

BY the decision of Judge Showalter in the actions brought by the Brush Electric company against the Western Electric company, reported in full in this issue, it is held that it is possible to construct a double-carbon arc lamp without infringing the famous patent granted to Charles F. Brush. Specifically, the Scribner lamps—both the old and the new types—are held to be so constructed, as they "do not contain mechanism constructed to cause the dissimultaneous initial separations of the carbons." The judge lays great stress upon the employment of the term "dissimultaneous" by Brush, and holds that, to infringe, a competing lamp must be provided with a carbon-separating mechanism operated in accordance with the idea intended to be conveyed by this word. This is a very important decision, and if upheld by the United States Circuit Court of Appeals, seems to open up the field for free competition in double-carbon lamps. The complainant company has six months in which to file its appeal.

ARBITRATION can be had in Illinois hereafter if the Senate concur and Governor Altgeld approve the bill just passed in the lower house by an almost unanimous vote. It provides for a state board of three persons who can arbitrate any difference between an employer and his employés numbering 25 or more, but if the parties to any controversy prefer, they can leave the settlement of their dispute to a local board to be selected by the parties themselves, which shall have the same powers as the permanent one. It is to be hoped that the Illinois law will be productive of more good than that which has been on the statute books of New York state for several years.

AN effort is being made to have a Cook county grand jury make a thorough investigation of the accidents on Chicago street railroads, resulting in death or serious injury to pedestrians or passengers. It is probable that a fairly conducted examination of this kind would disclose the fact that a majority of the accidents are due to the negligence of the victims. It is to be expected that carelessness or recklessness on the part of employes may in some cases be found to be the cause of the accidents, and prompt punishment should be meted out to these offenders. The chief trouble with investigations of this kind is that those having them in hand seem to consider it their duty to return a sensational report.

MANY sensational reports have been circulated in connection with the electrical execution of murderers in New York, but by far the most astounding statement published is that furnished in an interview with Dr. P. J. Gibbons of Syracuse in the *Democrat and Chronicle* of Rochester. Two of these statements require investigation. They will be found in another column, and as they contain very serious charges the matter should be thoroughly investigated by the Legislature. The warden of the prison in which the executions referred to by Dr. Gibbons took place denies the accuracy of the Gibbons account, and he is supported in this statement by other witnesses. It is alleged, too, that Dr. Gibbons is endeavoring to promote the sale of patents upon his "system," and has taken this method of advertising himself and his inventions—a very questionable proceeding, if it be true. However, as Dr. Gibbons has made the charge, he should be compelled to prove it or repudiate the interview. At any rate the question should be considered by competent scientific men and the dispute settled before any more executions by this method are attempted.

ACCORDING to the Chicago daily papers the mayor, controller and chairman of the finance committee of the Common Council have made contracts on behalf of the city with local commercial lighting companies for furnishing lights at the following figures, in each instance the contract being let to the lowest bidder: People's Light & Power company, 128 lights at $105 per light; People's Light, Power & Motor company, 132 lights at $105 per light; Hyde Park company, 60 lights at $84 per light; Mutual company, 43 lights at $82 per light. These figures should be carefully considered, as they show that the streets of Chicago can be lighted far more satisfactorily and at much less cost than under the present arrangement, provided the city made contracts with commerical lighting companies. Of course in case long-time contracts were made, more advantageous figures could be obtained, but even with yearly contracts the city could do much better than under the present arrangement. The city of Chicago pays an immense sum of money every year for lighting its streets, but the service is poor for the money expended, and visitors wonder that the second city of the country, famed for its enterprise, should be so far behind in this matter of street lighting.

IT is promised that the experiments in the application of electricity to canal boats will be continued upon the Erie canal this fall on an entirely different line from that originally contemplated. An experimental line, four miles in length, will be built at once. Along each bank of the canal it is proposed to erect a pole line, the poles to be of hollow steel and set in cement, extending 16 feet above the ground and outside of the towpath Upon the tops of the poles will be placed a steel cable one and a half inches in diameter. Fourteen inches below this cable will be a second cable one inch in diameter. From the top cable will be suspended a traveler or car, which operates on that cable. In the traveler, or car, will be a shaft around which the lower cable will make three turns, and this shaft will be operated by an electric motor. The current will enter the motor from the upper cable, and pass out through the lower one. A motorman will operate the traveller in the same manner as an electric car. The traveller will tow the canal boats. This, in brief, is an outline of the plan of the proposed experiments, and it is believed that it possesses many advantages over the original system given a trial some time ago near Rochester. It is to be expected that many changes will be necessary and that it will be some time before the scheme will be commercially successful, but there seems to be no reason why electric propulsion of canal boats cannot be made thoroughly practicable and economical.

IF the American Street Railway association desires a really interesting topic for general discussion at its Montreal meeting, it might take up the subject of the relation of street railway companies toward municipalities, and the rights, privileges and obligations of both, with especial reference to the subject of compensation for franchises, rate of taxes and licenses upon cars in operation. It may be assumed that a vast majority of managers of street railway companies still believe in the policy of securing franchises from city councils without direct compensation to the city, preferring to exercise such influence as they may be able to bring to bear upon the aldermen to grant their petitions. At times this policy proves very costly to the company, and in many cities it is said street railway corporations have found it necessary to contribute large sums of money toward securing the election of certain men who were known to be favorable to their interests. Of course no street railway company would admit having done anything of this kind, but there is no doubt that this and similar methods are employed to influence municipal legislation. In cities where competition is sharp the aggregate expenses of the companies are known to reach a figure that can hardly be realized by the public. An illustration of this is found in the statement attributed to an officer of a Philadelphia company in connection with the consolidation of the Quaker City lines last week. Speaking of the great items of economy to be brought about by the combination, President J. J. Sullivan of the Electric Traction company said the saving would be great, and a People's line director added this significant fact, according to the published report: "It means there will no longer be a contest for control of city councils. This item, with other economies along similar lines, that could not be effected with our vigorous competition, will mean a saving to the company of $500,000 every year."

This announcement has been received with general surprise, and many other cities are asking how much the street railway corporations have to pay for privileges. A Denver dispatch says: "The tramway company has a large majority in this council and measures against that corporation are quietly pigeon-holed. It is impossible to ascertain how much this isolated corporation expends. It is currently rumored in political circles that when the company in 1893 took a hand in the county campaign it expended $80,000. This year the fight politically has been a joint affair between the water company and the street railway company, their issues being pooled, both corporations agreeing on candidates before the conventions." Granting that these statements of expenditures are greatly exaggerated, would it not be good business policy for street railway companies to charge their methods of securing franchises? Let them purchase these rights from the city and have a definite understanding or contract explicitly stating what is required of them. Such an arrangement would possess the advantage of making the companies much more independent of the city council's, and it is believed it would also improve the financial standing of the corporations. If any proof of this is wanting, reference may be made to the plea of Receiver Payne of the Milwaukee Street Railway company, who charged that the interference of the aldermen had made it impossible for the company to secure loans. It may be that Mr. Payne only half stated the case. Certain it is that no city in the country has given more encouragement to local enterprises of this character than Milwaukee, and it is also true that many local capitalists have been shamefully treated in the management, or rather mismanagement, of this railway company. Mr. Payne and his associates would have done much better had they conducted the Milwaukee Street Railway company strictly in accordance with recognized business standards. Such failures as that of the Milwaukee concern have their advantages—they serve to impress the public with the necessity of a change. This experience should have a salutary effect upon other companies. It should be remembered that every business enterprise must pay in one way or another for every advantage it gains, and it would appear that the best way to conduct the affairs of a corporation of this kind would be in an open, straightforward manner. Buy franchises from the city; do not depend upon the favor of aldermen. They will not give you anything of value for nothing.

## Central Station Economies.[1]

By L. S. STEPHENS.

My subject is so broad, covering as it does practically the whole field of conversion of heat energy to mechanical, mechanical to electric energy, and the many sided question of its economical distribution, rounding up with the nearly always uncertain questions of really how much per commercial unit of value the electricity has cost, and why it has cost so much at the point of delivery to the consumer, that I can only touch lightly upon some few of the many questions that are worthy of consideration.

To speak of location of an electric light or power plant as belonging to central station economies will appear to some as foreign to the subject, yet the installation of many plants without due consideration given to this matter of proper location has, I believe, had as much to do with the failure of many investments of this sort to furnish satisfactory returns as many other matters that are usually looked upon as of greater importance, and I believe each year will bring with it some stronger practical argument in support of this view.

We have now to consider relative location of plant to centers of distribution, proximity to water and fuel supply, cost of property and possibilities of future combinations of light and power supply; use of exhaust steam for heating in winter, and in southern sections the feasibility of combining a refrigerating plant with the electric lighting or power installation. In many cases a possible combination of factory power, either electrical or directly driven, has been entirely overlooked. All of these have a proportionate and determinable value. I have not undertaken to enumerate them relative to their value, from the fact that different conditions due to different locations will vary the relative value. This much I would advise: Do not slight this question of location. It truly belongs to the economical operation of your plant, and may often prove the prime factor in success or failure of an electrical venture. Employ a reliable, experienced, practical engineer, and employ him early—before you decide where your plant shall be located. Have him determine a value for the governing conditions in your case, and acting on this information you will at least have to your credit an advantageous position.

I do not think I am far wrong in saying that in the inception and installation of the majority of smaller-sized electric light and power plants, the one item, usually of minor importance, cost per square foot of land, has been the controlling factor. This for the same reason that too often holds good throughout in the practical handling of the economies of a central station, the financial control being in the hands of those who know 99 cents from a dollar. And as electricity is an imponderable quantity, which they believe, and which too often has, an uncertain value, they jog along on the 99 cent basis fearful of their own ignorance of thermodynamics, dynamic and electrical generation and distribution, frankly believing that all these are uncertain, unknowable quantities, and that the dollar and cents basis, pure and simple, is all-sufficient.

The plan and construction of a building to contain an electric light or power plant should be governed by the reasons already mentioned. In reference to location, the question of adaptability to increase of power, the question of rates of insurance and possibility of permanent, simple construction, that is perfectly adapted to the work and practically fireproof, have not always had due consideration.

This matter of a suitable building is of great importance. There are too many fire-traps covering costly machinery; hot and dirty electric light and power stations that consist of an aggregation of pitch roof, French roof and flat roof shacks whose number and date of construction can only be guessed at by the different angles on the outside and the color of the interior sheathing. And another extreme, though not so common, is the building of brick chimneys, in themselves good, but in the cases in mind unsuited to conditions, the greater proportion of a capital upon which the business in view would pay interest being sunk in these permanent investments to the exclusion of purchase of economical machinery and intelligent service. Both of these extremes are too well known to require further illustration.

For a growing district, build with a view to future enlargement. Don't build a fire-trap; the difference in insurance will pay the interest on a properly designed, fireproof building, even for a small station. Don't forget that electrical machinery, like a great many other things, unnecessary to mention, will keep best in a dry, cool place, and that such a place means a saving of dollars in proportion of power required to collection for service rendered.

The choice of suitable steam power machinery, or provision for the first transformation in the series between the coal pile and the lamp or power at the other end of the line, is in importance proportionate to cost of fuel, and yet what may be the very best engine and boiler and detailed arrangement of steam power for an ordinary manufacturing plant is not always best for an electric light and power station in the same locality and with the same cost for fuel. A simplicity of detail, proportion of parts and permanency of construction that will give continuous reliable service is preeminently necessary to obtain satisfactory results.

With the really small difference in cost per horse power between suitable boiler capacity at a safe working pressure of 140 pounds, with compound engines, and the ordinary working pressure of 80 to 100 pounds, used in the smaller plants with single cylinder engines, the cost of coal would usually have to be less than one dollar per ton where it would not pay to use the compound engine and higher steam pressure. In deciding upon boilers and engines, too much dependence should not be placed in the usual guarantees of efficiency. Such guarantees are useless unless some prearranged plan be provided to determine their fulfillment, and better still, some penalty and premium proportional to the value of difference in economy. Such a plan, however, is usually impracticable, and the question can be best decided only by a thorough knowledge of the requirements of the case and the many styles of boilers and engines that are offered, and good judgment governed by practical experience.

You cannot get the best or most suitable engine and boiler, pump or heater by considering proposals from all comers and purchasing at the lowest price, and on the other hand there are both boilers and engines on the market at the present time obtaining a large share of patronage, the commercial success of which are due mostly to the ignorance of the purchaser regarding these matters. In the installation of your plant keep the main issue, the most light and power attainable for the least cost, clearly in view. There are more stations running at the present time that are losing more money from improper proportion of parts, design of steam connections, unnecessary shafting, bearings and belting friction and preventable electrical losses than all the money that can be shown on the credit side.

The relative efficiency of the different designs of electrical machinery and adaptability to any particular service is mainly a question of local conditions. The varying range of efficiency as compared with the steam power end of the plant is small, and while the direct-connected dynamo and engine will always make the best mechanical construction, I am not convinced that saving due to this method of driving will always pay interest on the actual difference in cost.

Further discussion of this and the question of direct and alternating current perhaps had better be left to the representatives of the different companies who manufacture these different classes of machines. They are always able to decide on this important matter, and it is not very hard usually to predict which way each will advise.

Even though all other details of installation and management of a central station be about right, the one item of distribution may, and has, I believe, proved a stumbling block to success in some instances. Careless proportion of wire to service required, bad joints and poor insulation are enemies of economy that may be found in too many plants at the present time. I have in mind several instances that have come within my experience lately that I trust may act as warning lights to others. Within a week's time, the weather being rainy and windy, while visiting a central station furnishing hundreds of arc lights, I saw complete circuits cut out on account of grounds three different times, and four or five men turned out in the rain to trace the circuit and find the ground, and in each case after hours of search it was found on the roof of some building, the last time within 100 feet of the station. The wiring had been done, shall I say, in an economical (?) way.

I have in mind two electric railway plants, one in the eastern and one in the western section of the United States. The managers of both were taking especial pains to see that the voltage at power station should not go above 500 as marked on the generators. Five-hundred voltmeters were in use, and I know for a fact that the average working voltage at the motors varied from 400 to 450. You can draw your own conclusions. Within the year (on a small alternating plant installed by one of the leading companies) I have had taken out 15 converters, ranging from five to 15 lights, all within a distance of not over 400 feet, an aggregate of 130 lights capacity. A single 75 light converter now furnishes the same service at a large saving in both first cost and loss of current. Proper regard for all of the matters so far mentioned will not bring full measure of success without the assistance and service of trusty, reliable and industrious help. I have heard a friend of mine, president of one of the large lighting companies, remark that his superintendent's head was not the right shape. I am not sure that he should blame the superintendent for this. Really good men cannot be retained for the wages that every Tom, Dick or Harry that comes along may be willing to work for, and a good man can usually save his salary if given a fair opportunity. Don't make machines out of your men. The interests are too varied for this to prove successful. Put some responsibility on them. Make them feel an interest in the results, and better still, if you have a proper system of operating your business, you can provide for a premium plan of operation that will actually give the men an interest and at the same time tend greatly to your own benefit in the economical operation of your station.

A thorough systematic method of records of service, including boilers, engines, dynamos and circuit losses, with properly tabulated monthly deductions or averages, along with a suitably classified system of accounts, will, I believe, do more to get things moving in the right direction than anything else.

The all-too-common way of bunching the expenditures and simply trying to keep them within the available amount received from collections may save book-keeping, but I believe it wastes an opportunity that might be made available to save some money, and at the same time provide a means of comparison if some standard system were used whereby better average results might be obtained.

On the mechanical or operating side, such records of fuel, steam pressure, horse power, electrical output of stations and current furnished to consumers, could be simply and easily kept, and, properly tabulated, would be of great value. Would it not be a move in the right direction for this association to take the initiative in this matter and formulate some system of record that can be easily kept and used for mutual improvement? I can understand that some will object to the bookkeeping end of their business being interfered with, but I can see no reason why some systematic record of at least the proportion and value of fuel used to electrical output of station, and proportion of station output to that furnished to consumers, should not be made for mutual benefit. With a record for one year of these items alone from the stations here represented, a foundation would be laid that I feel confident would be built upon, and the data so obtained would certainly be of great value to this association and to the different central stations by providing a reliable working basis for improvements tending to the more economical production of electric light and power.

### Discussion.

PLINY NORCROSS: I would like to ask this question: In fitting up a plant, is it more economical to put in two small engines than one large one? What would you advise about that? I don't know much about a steam engine, but I may have occasion to in the near future, and I want to get all the information I can. Is it better to put in a pretty good sized bank of boilers and then use the steam for one engine or two engines?

MR. STEPHENS: My idea in putting in a small growing plant would be one engine, and later on to use the two engines. I have found in my experience that a plant will grow so quickly, if it grows at all, that one engine, if put in just large enough at first, will shortly become too small, so that the second engine to provide for an emergency is soon necessary for regular operation of the plant; while, if the load first determined on were divided between two engines, you would later on have two small engines to throw away. If the right sort of engine is put in, it will run for a long time without trouble from shut-downs. I have known engines to run electric light plants four or five years without any stopping on account of trouble from engines.

MR. NORCROSS: I was thinking of the marked variation in load at Christmas time and at the Fourth of July, and how best to utilize the same apparatus.

MR. STEPHENS: I would say it would be more suitable to use the compound engine, which has a larger range of power, than a single cylinder engine. You could carry 140 pounds on the boiler at Christmas, or when the load was heavy, and then have in the main steam pipe leading from your boilers to the engine a reducing valve which could be adjusted by the engineer, so the engine would be working under the most economical conditions with a lower pressure. That is one main advantage in higher pressure for a compound engine plant of that sort, and will give a large range of power economically.

A. V. ABBOTT: The statement is made that, excepting in locations where the cost of coal is less than $1 per ton, it would probably be better to use the compound engine. I think compound engines at the present time are perhaps going out of fashion to some extent. A compound engine worked at high steam pressure is by far the most economical form of engine, providing the load factor is such as would cause the engine to work most economically. But in many of our electric light plants the load factors are such that the engine works for a number of hours each day at a ruinous loss. I have a case particularly in mind. An electric railroad was installed in one of our western towns, the company purchasing a Fraser & Chalmers compound engine—a beautiful piece of machinery. It was set up and worked admirably, and at the end of the year they found the cost of power delivered on the engine shaft was in the neighborhood of $100 per horse power per annum. They held a post-mortem examination and found that the engine, which was operated 15 hours daily, was spending 40 per cent. of the output of the engine in pumping the atmosphere. That is to say, the low pressure cylinder was exhausting below the atmosphere, and being a high-pressure engine, as there was no water available for condensation, coal was being consumed all the time to drive the low-pressure cylinder against the air. I am not stating this as an argument against the compound engine, for I am a thorough believer in them, because I have installed a great many. A compound engine which is run condensing is more economical than one non-condensing. But with the condensing compound engine, the load factor must be such as to require nearly all the power of the engine the most of the time, or the engine will not work economically, and it would be better to install the simple engine. In the case cited it would have paid the railroad company better to cut their cylinders in two and supply full boiler return to each cylinder, rather than to exhaust from one cylinder into the other.

MR. STEPHENS: I have met just such instances as the last speaker has outlined, but I still think if the matter were followed up, and a compound engine properly designed and installed, with the minimum economical point of cut-off so arranged as to make the requirements of lightest load, with a low steam pressure, that the possibilities of the compound engine to meet the requirements of a larger load by its greater range of power due to range of cut-off and increased steam pressure, will fully meet the requirements of any usually varying change of load that two single-cylinder engines would be capable of taking care of, and the compound would do the work more economically. The trouble has been in such cases as Mr. Abbott speaks of, that the engine has not been properly proportioned to the load, or varying conditions of the speed and steam possible have not been properly taken advantage of.

JOHN SCHUETTE: The only experience I have had is with the Corliss condensing engine. I understand there are some engines arranged so that you can throw off the low-pressure cylinder and run the high-pressure only by adding another cylinder. I would question the statement as to the doubling of power, as given by Mr. Norcross, who says when they want large power at Christmas time they use two cylinders, throwing off one and working economically by simple condensing during time of light load. Can you do that?

MR. ABBOTT: Answering the inquiry of the last speaker, permit me to draw from my experience a little. One railway was installed under these circumstances: A Fraser & Chalmers cross-compound engine was installed. I would not be absolutely certain as to the dimensions, but my recollection is that the cylinders were 24 by 36 by 36 inch stroke in the engine and were arranged so that either side of the engine could be worked independently of the other side, as a simple engine, or the two cylinders coupled and the engine operated as a compound engine. The hope in this installation was that when the plant was first set in operation the small cylinder could be operated as a single engine only, condensing, for there was plenty of water. Then as the load increased the other side of the engine could be put on and the plant operated as a compound engine, and in the event of the failure of either cylinder, the other side could be operated as a duplicate part of the plant. On the whole the results were very satisfactory. Of course it may be readily understood that inside of a year the plant grew to such an extent that a duplicate engine was rendered essential any way. But this served as an expedient in the operation of the plan the first year, so that during the hours when we had a light load we operated as a simple engine and during the hours of heavy load as a compound engine.

P. H. KORST: In regard to the suggestions for formu-

1. Read before the Northwestern Electrical association, Chicago, July 17, 1895.

lating a method of keeping a count to be used by the different stations showing the cost of the various parts of operation and adoption of some report which will not be too complicated, I would like to say: We came here to get as much good as we can, and if we all keep notes, when we come together we can compare them and find out where the leaks are and try to stop them. Of course we can get a great deal of good in that way. A great many of us do not make reports nor know how to make them out. If we can formulate serviceable reports and find out where we are short and the reason why, I would like to see some action taken upon that point.

THE CHAIRMAN: The matter is before the convention and the members can think it over and if they see fit, take some action upon it. I would like to ask some of the managers and operators to give their experience in starting on a small scale, where they had to keep on increasing.

MR. NORCROSS: Perhaps if the bookkeeper was honest he could show where the lost money went to. When our bookkeeper makes his report, we know it is right, but when we started in we were a little afraid of it. What we want is to get the experience of those who can give it. That is why I asked the question about the advisability of using two small engines or one large engine. There are only a few hours out of 24 when the large load is needed; thus I would like to get the experience of those who have been through that part of it, and learn whether it is better to have two engines to begin with, both of moderate size, or to have one large one. In other words, whether a large engine operated for a few hours each day to fill a large demand is more economical than one small engine driven a large number of hours, and then both engines for two hours. A month from now we start to run at four o'clock and run all the lights we have until nine or ten in a town of 10,000 to 14,000 people. From ten or eleven at night until three in the afternoon you use hardly any current, yet in some house a person wants to go down and get some vegetables for dinner and wants a light. Here we should have a small engine to take care of the light load, supplemented by a large engine to fill in a few hours. I would rather have the anticipation than to have the report of the bookkeeper afterward, for they are always asking the stockholders to put up something. You cannot open up an electrical journal but it advises us of new situations. We want to get all the experience we can.

JOHN R. MARKLE: I have had some experience in wrestling with this problem of proportional engines and other things, and it resolves itself in my mind to this: We should put in proportional engines; that is to say, in proportion to our capacity and having regard to the population of the place in which we are about to embark in business. This should be determined the first thing for various reasons. First, that the losses occurring in operating an electric light plant are not confined alone to the engine, but are distributed over boiler, engine and dynamo. None of these will work efficiently with a light or partial load. Now if you put in a large engine for a small population, it is manifest that you cannot have a good load factor. Here is where the weal or woe of the business hinges—your load factor. If you put in a boiler, engine and dynamo they should all be of light capacity and proportionate to the population of the place in which you work. You will then begin your work on a good load factor; that is, you should have about 66 per cent. of a load on that unit, which you will need to get a good result from the steam engine and boiler. When you have got that unit loaded, thrown in your second unit. You throw them out in the same manner. It ought to be manifest to anyone here that that is the only way you can get a good load factor, working direct. It is my experience that that is the whole problem—to intelligently determine what the capacity of your units wants to be to fit your population, to get it right.

W. B. CASPAR: I am not a member of this association, and I do not know but I am out of order, but would like to make some suggestions. I represent the Consolidated Car Heating company. While you are dwelling upon this subject of generating current, I would like to say that if I did not meet with so many objections to the high prices for producing power for heating houses, I could increase the sale of electro-heating apparatus. I am just this morning in receipt of a letter from a gentleman in Indianapolis, who is considering the advisability of heating some of the rooms in his residence by electricity. Electric heating has come to stay, as far as street cars are concerned, and we are making nice progress in heating residences. While, of course, it may be considered more of a luxury in residences, most people who can afford that luxury are willing to pay a little more for power than they would in heating street cars. The difficulty has been the excessive charge for current from the lighting or power stations. If the gentlemen present would take this matter up and decide on what they could afford to produce power for, with perhaps 10 per cent. of profit, it would give me some basis for calculating the cost of current to people who desire to heat their residences with electric heaters. I merely offer this as a suggestion.

F. A. COPELAND: I will give you a little experience in starting a plant. In 1887, Mr. Leonard (I presume you all know him) came to La Crosse, and laid the thing out so flatteringly that we started in. In looking the town over we calculated that we could get about 2,000 lights. But it occurred to me that it was a great deal easier to get a little more money on the start than it was to keep calling for assessments. I put in a plant of a capacity of 2,000 amperes to start with, with three boilers and two 150 horse power high speed engines. The second year I put in a 75 horse power engine, with dynamos, as I found my load during the day was pretty light. As a consequence, we have 12,000 lights attached and have not made a single increase to our station. I am putting in now a power of 75 kilowatts direct-connected, more for the purpose of having duplicate machinery than the amount required. My total capacity now in amperes is 2,000, 1,000 on the side. We have run during our fair, for the last four years, 2,800 amperes on those machines for four hours each evening for a week, and haven't made a skip; but it was taking lots of chances. With this addition I will have an additional 600 which will make me 3,200 amperes without increasing boiler capacity. In 1891 I put in a condenser and saved 25 to 30 per cent. of my fuel. Now I am putting in a high-speed compound engine. My advice would be in starting a plant that one had better shut his eyes and build it 10 years ahead. He is not going to put in a small plant if he thinks he is not going to increase it. There is no object in it. But he should shut his eyes, look to the increase, and build to that.

THE CHAIRMAN: What would you advise where you have already started your plant, and must increase? How would you do it? Throw out the small engine?

MR. COPELAND: No, sir; I would just add on. I believe in small units.

A MEMBER: You believe in two or three small engines instead of one large one?

MR. COPELAND: I do. The way I am fixed now I have got a 75 horse power engine, the full capacity of which is 200 amperes. I can run it down to 100. When I get more than 200, I switch in the engine which has a capacity of 400, and when I get above 400 I cut in my little engine, which allows me to run to 600.

A MEMBER: In other words, buy a ten-acre lot for your boilers.

MR. COPELAND: By putting in plenty of boiler capacity you will not use your boilers hard; you will give them a rest. All kinds of machinery, boilers as well as anything else, must have a chance to rest. So I do not think there is any economy in putting in just what you need to use.

MR. MARKLE: If I understand Mr. Copeland aright, his idea is to make a large investment for 10 years ahead.

MR. COPELAND: No; I do not.

MR. MARKLE: That is the trouble with storage batteries. They require so much money; you have to pay so much to get a small capacity. If I understand Mr. Copeland, he would make a very large investment for the purpose of anticipating future business. That while he had a chance to get any, he would get all he could and tie it all up. It seems to me that is rather hard for the stockholders. That, Mr. President, has been one of the handicaps to this business. It has been one of our chief troubles. We have got the investors scared. There are few people who have any use for this business because of its unprofitableness. Investments have been made without proper engineering. You should properly provide time to install an electric light plant. It would be a simple problem to begin in a small town with a three unit establishment, with, say, a 50 horse power boiler, 50 horse power engine and 50 horse power dynamo. A population of 100,000 would certainly show a proportionately larger unit that could be employed and have no dead capital. The increase of an unnecessary investment is as hard a handicap as anything you can put on a business. Unless you can make a good showing with an electric light plant in a city, you cannot interest further capital.

MR. KORST: I would like to say that we have two Corliss engines running condensing. We start one up and run it until the load commences to come on, and then start the other. When our full load is on we carry a steam pressure to the maximum point. When the load goes down we let steam go down, so that our engine is always working at a good point of cut-off. At 12 o'clock, when some of our lights are off and a good deal of our commercial load, we drop one engine entirely, and run one through till morning with low steam pressure, and we get quite good results. Our average result is 11 to 12 pounds for a kilowatt. The coal we burn is screenings, which costs 40 cents a ton at the mines.

MR. MARKLE: I would like to call the attention of members to the point of having a small unit. We will say the large unit fails during the hour of maximum load; your whole station is broken down; you cannot carry with the other two. There is the fault there; otherwise, with proportioning it would be all right. With the proper proportion and making your units more uniform in capacity, you are not so affected. The loss of one small unit, of one unit of a class to which I refer, could be suffered and not lose the business, that is, not break down.

MR. COPELAND: That is just the point I would like to get at; in regard to the breaking down. We know that the gas folks do not break down; they always give light. But if an electric light plant stops for five minutes, then there is a howl. You can better afford to put in that extra money and have duplicate machinery so you can have light all the time, than to run the chance of the kicks you will get and customers you will lose. I would say in regard to our plant that we have run it nearly eight years. We have failed to give light twice. Once the superintendent had a bull pup running around the station. He got in between the flywheel and belt. Of course, we never saw anything of the pup or belt either afterward. We had another unit and could change over in three or four minutes. Another time I gave a contract to a fellow to line up our boilers and he was to have them done by Saturday night, and we used one boiler during the week. As luck would have it, this Saturday night something got under one of the valves in the condenser. I could carry my load with one boiler on condensing, but with high pressure I could not do it. And, of course, the condenser being shut down, we had to change to high pressure and open the condenser and take that out; and before we got it out the steam had run down so low in the single boiler that we were obliged to stop, and we stopped just seven minutes.

A MEMBER: I would ask what kind of a boiler you had?

MR. COPELAND: A straight tubular boiler 66 by 18 inches.

CHAS. E. GREGORY: In speaking of a small beginning, I have an experience in mind that occurred to me in a suburb. In 1889 we had a franchise in Hyde Park. We were anxious to protect that and thought we would put in a little plant, large enough to hold that franchise, to show we were doing some work. In February, 1889, we started up with 17 lamps. We had an old 60 horse power engine, tubular boiler, and another 50 horse power boiler in reserve, and in two years we counted 1,056 arc lamps rented to commercial users. We commenced the operation of that station in that way, and increased from 17 lamps to 1,056. Perhaps it is a little less now since the hard times, but I have sold out. We threw away the first steam plant and put in boilers of 900 horse power, with oil for fuel, and we had two compound condensing engines and one McIntosh & Seymour 150 horse power single cylinder. We used the condensing engines until the load became so great we were compelled to put in the other engines. And our fuel saving by that means was 40 per cent. over a similar experience I had had in a 300 light station before that. We had the advice of a competent electricial engineer in building the new station. I think it would be good advice to say to those contemplating the building of a station, to give a few hundred dollars to a man who makes a business of advising how to install a station.

MR. COPELAND: Another point in favor of starting good sized and putting your building up large enough to contain your machinery, is that you have not got to make additions. If you start small you perhaps would not think of putting a 50 horse power engine and dynamo in a building where you could put in a 200. But it does not cost much more to put up a large building than a small one. I have put in my fourth engine and have room for three more. Yet the building did not cost much more than it would for a small engine. And you cannot put up decent looking shop with nothing but additions.

## Trolley Car Accidents in Chicago.

Since the extensive introduction of the overhead trolley street railway system in Chicago there has been a number of accidents, and the *Chicago Tribune* asserts that the present grand jury is investigating the subject. One of the grand jurors is reported to have made this statement:

In New York state grand juries have been investigating railway officials with a view of indicting them for murder, and that is what we propose to do. We have information that the companies have killed more people than the public imagines, and in many cases the real facts have been suppressed by claim agents. In many cases, too, we are informed, claim agents have bought off witnesses to prevent persons who had claims for injuries from collecting anything, and we will investigate that branch of the subject. We will send for the books of the companies to see what sums have been paid out in connection with accidents and for what purpose.

An officer of the North Chicago Street Railroad company is credited with this comment:

Modern civilization demands rapid transit, which necessarily is more or less dangerous. The tendency is to secure the safest. Actual experience proves the trolley is the safest and best system ever devised. It is safer than the cable because the speed can be regulated and because the motive power is under the control of two persons instead of one. It is as easy for the conductor on a trolley car to stop the car as it is for the motorman. We have run our cars on North Clark and Water streets, where every morning there is a jam of all sorts of wagons, for months without a mishap of any kind.

Frank L. Fuller, superintendent of the West Chicago Street Railroad company, said he was surprised to think there is to be an investigation. He said:

I see no cause for anything of the kind. There certainly have been no accidents on our lines to cause such as investigation, and particularly not on our electric lines. We have had since they started few accidents and but one fatality. This was due to the intoxicated condition of the man who was killed, and was entirely unavoidable. We have fewer accidents on our electric lines than on the cable lines, yet the former run as fast as the cables. I think the investigation of the electric lines of the city will fail to bring forth anything which will justify an indictment, and the grand jury will have its trouble for nothing. We never run any of our cars faster than the city ordinance provides, and have nothing to fear from the investigation.

## Suburban Electric Lines at Chicago.

General Manager Ainslie of the Chicago & Northern Pacific railroad says that electric power will be used for all the Chicago suburban trains of that extensive system. The change will be made within four months. It is said that a large power plant will be erected at the Grand Central station at Harrison street and Fifth avenue.

Another electric railway improvement in sight is the construction of a trolley system along the line of the Chicago, Burlington & Quincy road. The franchise provides for several lines, aggregating about 12 miles in length. They are to be constructed on the following streets:

On Harrison, from Forty-fourth to the west line of Cicero.

On Robinson, from Lake to Twenty-fifth.

On Twenty-second, from the city limits to the west line of Cicero.

On Riverside boulevard, from Twenty-second to the east line of Riverside.

On Hiawatha from Twenty-second to Thirty-ninth.

Branch lines will run to the cemeteries in the territory covered by the system. Connections will also be made with several of the older systems. The Lake Street "L" will be tapped at Robinson avenue, the connecting line passing through the property of the Grant Locomotive Works. The Metropolitan "L" will be reached at Harrison street and the city limits and at Twenty-second street when the southwest branch of the road is opened. A connection will be made with the Chicago & Northwestern railroad at Linden Park. The men backing the enterprise say the line will be extended to Lyons, though the franchise does not show that. The franchise requires that the new system shall be completed within two years and put in operation, the penalty being a forfeiture of the grant.

## Inverted Arc Lamps for Cotton Mills.

Much interest has been aroused by the new method of lighting mills and shops which has been in successful use for some time in a mill in Pawtucket, R. I.

In reply to an inquiry, D. L. Goff of Pawtucket has written a letter, which was read before the New England Cotton Manufacturers' association this spring. He says:

We have had 42 inverted arcs in use during the past winter and before next winter intend to equip our entire works. We find that the cost of installing 100 incandescent lights, or their equivalent illumination in arc lamps, is about the same with the present low price for arc lamps. The cost of maintaining the arc lamps at the present price of carbons and including interest is about the same as renewals on the incandescent plant. In favor of the arc lamps you must remember that they are always up to full candle power, while the incandescent lights begin to deteriorate from the moment they are put into service, and as they are generally allowed to burn too long the result is that the illumination becomes very unsatisfactory. We have been using incandescent lights, 20 candle power, for nearly 15 years, and so far as cost and illumination go we prefer gas. We have long wanted to use the arc lamp, but its intense light and deep shadow has seemed to forbid its use in posted rooms or rooms having much shafting and belting. Now that we can light by reflection, so that there are absolutely no shadows, the arc being invisible, while a soft mellow light reflected from a white ceiling is evenly diffused, we think we have found the ideal system for mill lighting. In the form in which we are at present using the light there is some criticism from insurance men about the danger from sparks, but we think changes can be made to cover that point, and with this modification we believe it is the best light yet invented for mill and store purpose.

Now, when I tell a man who has not seen this method of lighting that it produces a far better illumination for much less money than lighting by incandescent lamps or by gas, he is inclined to doubt my statement, and probably says to himself that I am mistaken and that it is impossible to produce more illumination for less money when we twice reflect the light, once from a reflector and again from the ceiling. I admit that this line of argument is plausible, and it may be that an arc light behind a plain glass globe loses a certain per cent. of efficiency, behind a ground glass globe a certain per cent. more, and it may be that with a reflector 50 to 75 per cent. of the light is theoretically lost. All this may be true; I don't know; but what I do know is that you can see more and better by a reflected light than by an open light. The human eye is the final test and not mathematical instruments, and one needs only to see the reflected lighting to appreciate it and be convinced. My theory is that the open light causes the pupil of the eye to contract, while the hidden light allows the pupil to expand, thus enabling the eye to see more with the same or less quantity of actual light.

But enough regarding the character and quality of inverted arc lighting. What you and many others want to know is whether it really costs less than other forms of lighting. This question we are able to answer in the affirmative, and I submit the following comparative tests made in the month of January last. The braiding room, in which the first test was made, is 136 feet long, 66 feet wide and 12 feet high. There are two rows of posts, a main shaft running about half the length of the room and three short countershafts about the center of the room. The machinery consists of 420 braiding machines, distributed in 14 rows of 30 machines each. The room was formerly lighted by 84 gas jets. It is now better lighted by eight inverted arc lamps, placed in two rows, each row 17 feet from the side walls. The lamps are run two in series on the continuous current system, 110 volts, each pair of lamps taking nine amperes of current. The test (2½ hours each evening) resulted as follows:

| | |
|---|---|
| The first evening 84 gas jets consumed 1,890 feet at $1.50 per M | $2 83 |
| The next evening eight arcs consumed 9,900 watts at 15 cents per M | 1 48 |
| Difference | $1 35 |

or a saving of 47 per cent.

A similar test was made in our worsted spinning room, which is of the same dimensions and contains 24 English spinning frames, 12 twisters and three spooling machines. This room was considered a difficult one to light, as the frames are high and the alleys narrow. The room was formerly lighted by 82 gas jets distributed so as to give the light where most needed. It is now better lighted by 10 inverted arcs. The result of this test was as follows:

| | |
|---|---|
| The first evening 82 gas jets consumed 1,845 feet at $1.50 per M | $2.79 |
| The next evening 10 arcs consumed 12,373 watts at 15 cents per M | 1 86 |
| Difference | $0.93 |

or a saving of 33⅓ per cent.

In these tests the price for gas is the price we pay to the Pawtucket Gas company. The price for electricity allows us a good profit for the making of it with our own plant. It is one-tenth of the price for gas per 1,000 feet, and this, Mr. Haskins of your meter department says, is a fair basis on which to fix a price for selling electricity for lighting.

## Los Angeles Transmission Scheme.

An ambitious project is on foot at Los Angeles, Cal. It is proposed to transmit the almost unlimited power of the Kern river to the city named by electricity, and to make a strong effort to build up a manufacturing center without begriming the "Italian skies" of Los Angeles with smoke and soot. The Kern River & Los Angeles Electric Power company has been organized with a capital of $5,000,000. The most interesting feature of the plan is the length of transmission. The nearest point on the Kern river is exactly 100 miles from Los Angeles. The promoters of the plan claim to have electrical engineering advice, however, to the effect that the scheme is commercially practicable.

## Wisconsin Telephone News.

[From the Milwaukee correspondent of the WESTERN ELECTRICIAN.]

The Wisconsin Telephone company has reduced rates at Appleton. House rates have been reduced from $2.50 to $2 a month and office rates from $3.34 to $3. Hereafter 10 cents a message will be charged between Appleton and Neenah, but subscribers will each be allowed 1,000 calls a year, so that most of them will not have to pay extra for service between the two cities.

At Eau Claire the Wisconsin Telephone company has reduced business rates from $40 to $34 and house rates from $30 to $24. Calls between Eau Claire and Chippewa Falls exceeding a certain number will cost subscribers 10 cents each. Supt. Whistler of the Eau Claire exchange created a sensation by stating that heretofore the line between the two cities had been used principally by young men and young women, non-subscribers, for the purpose of "sparking." He declared that the free use of the wire for flirting had grown to an alarming extent. Somebody suggested that an electric wire was, after all, the most appropriate means of sparking.

The Wausau Telephone company has been organized with a capital stock of $10,000, and F. P. Crocker, for years the manager of the Bell plant, is the manager of the new company. It will operate exclusively in Wausau. The officers of the company are: President, N. Heineman; vice-president, H. P. Maynard; treasurer, W. W. Albers; secretary, James Montgomery.

## Era of Cheap Telephones.

[From the *New York Times*.]

The idea is gaining ground that the day of cheap telephones for the million is at hand. Whether this impression is soundly based is an open question; but there can be no doubt that many rough-and-ready utilizations of the telephone are now being made in which the fear of infringement suits plays a very small part. For instance, a number of South Dakota farmers have helped themselves to a telephone system covering eight miles of wire by supplying themselves with transmitters and making connections with the barb wire which constitute the fences in that part of the country. The staples have been removed from the fences along the talking line and insulated fasteners substituted. The farmers have thus managed to secure at the expense of a few dollars each what is practically useful to them as a regular exchange system. Incited by the success of this installation, a number of stockmen propose to build a telephone line from Pierre, S. D., to Midland, a central point in the cow country, for the purpose of securing storm warnings from the Pierre Weather Bureau. In that part of the country, as is well known, storms swoop down at certain seasons with such suddenness and severity that fast riders are kept in readiness to carry the warning of impending cyclones from one post to another. The greater promptitude of communication will be a boon to the community. A special field is also being opened up for the telephone in many countries where isolated residence is attended with more or less danger. In Mexico telephone lines are being run to haciendas that are twenty, thirty and even sixty miles from the nearest village. It is proposed to have regular installations on the Indian tea plantations. Such service would give the planter an immense advantage by placing him in instant communication with all his coolie lines, besides greatly mitigating the hazards arising out of the isolation inherent to the industry.

## Philadelphia Electric Railway Consolidation.

A press dispatch from Philadelphia, under date of July 23d, says: The plan to unite the Philadelphia, People's and Electric Traction companies, which has been in process of negotiation for several days, was finally completed to-day. The plan provides for the amalgamation of the People's and Electric companies, the consolidated concern then to lease the Philadelphia Traction company at 4 per cent. on a par of $100, which is equivalent to an annual dividend of 8 per cent. on the company's capital stock. The new company will have a capital of $30,000,000, the limit permitted by law, and the shares will have a par value of $50 each, making 600,000 shares. The shares will be held at the disposal of the different companies as follows: Philadelphia, 310,000; People's, 155,000; Electric, 135,000. John Lowber Welsh, president of the People's Traction company, and also one of the receivers of the Reading Railroad, will be the president of the new company. The agreement has been signed and all that now remains to be done is to submit the plan for final action to the boards of directors of the respective companies.

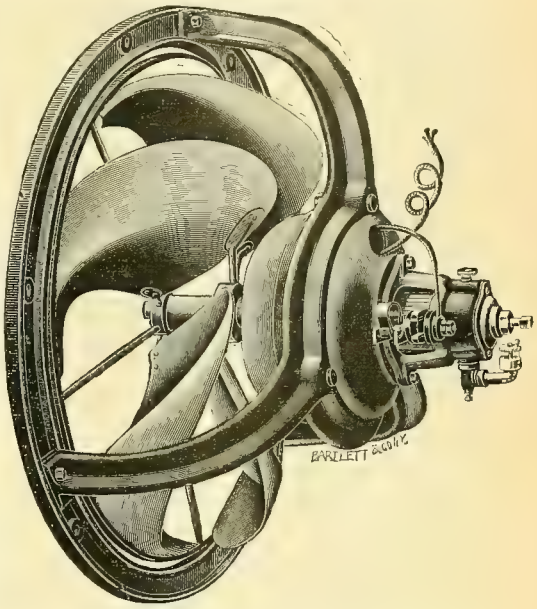
## General Electric Company's Affairs.

In a recent hearing in relation to a prosposal to close a street in the neighborhood of the General Electric company's shops at Schenectady, N. Y., J. P. Ord, second vice-president of the company, testified that the General Electric company is interested in manufacturing at Lynn, Mass., where 2,000 men are employed; at Harrison, N. J., where 900 men are employed, and at Schenectady, where the number employed is 4,400, and the weekly pay roll $45,000. Mr. Ord gave it as his opinion that if the company were allowed to build on the site of the street in question (Kruesi avenue) the largest electric manufacturing establishment in this country would be located permanently in Schenectady and in due time the number of men now employed would be doubled.

## Lundell Exhaust Fan Outfit.

The cut shows a Lundell exhaust fan outfit made by the Interior Conduit & Insulation company of New York. The design of the Lundell motor lends itself most readily in application to exhaust fan work. The motor, being iron-clad, is almost wholly inclosed and easily permits of connection by radial arms, spider, or bolts to any of the many forms of exhaust fans now to be found in the market.

It has been the practice of manufacturers of exhaust fans to supply a bearing in front as well as in the back of the fan, but in this application there is a shaft which may be horizontal or vertical in two bearings in the motor frame itself, not supporting the shaft in any sense from the fan ring. This course insures perfect alignment and noiseless running. All exhaust fan outfits are made with horizontal shafts, unless otherwise ordered, and are invariably made so that the direction of the flow of air is from the motor toward the fan. With all standard horizontal shaft fans, an adjustable thrust bearing, as shown in the cut, is provided. When the flow of air is desired contrary to the standard direction a button and thrust bearing is placed at the rear of the motor. In all horizontal shaft fans lubrication is effected by oil. In




LUNDELL EXHAUST FAN OUTFIT.

vertical shaft fans lubrication is effected in an oil receptacle enclosing a step at the bottom of the shaft and a graphite or other self-lubricating bearing (never a grease cup or oil bearing) at the upper end of the shaft. Particular care should be taken to see that the white line marked upon the motor is in a vertical position when the fan outfit is erected.

## Electricity in the Oil Fields.

Wheeling operators will soon put into operation at Sistersville, W. Va., an electrical device which will work a revolution in the oil industry. Heretofore the great drawback in developing an oil field was the necessity of hauling boilers to the well sites and furnishing them with fuel and water when they had been located. It is proposed to put an electric motor at each well and furnish power from a central electrical plant, a single circuit being sufficient to take the place of the fuel and costly water line. Heretofore the cost of a well in this field has averaged about $3,500, of which at least half was the laying of water lines and hauling fuel. By this plan it is thought that wells may be put down for $2,000 each.

The value of the electric power will be even greater in pumping fields, where at present fuel must be hauled continually, and wells of small production will not more than make up the cost of pumping. With the application of electricity 20 wells may be strung on one circuit and all furnished with power from it. It is the intention to get a plant in operation at Sistersville by the first of October.

## Electric Fountain at Atlanta.

The electric fountain at the Atlanta exposition, designed by Luther Stieringer, will be supplied with water from a Worthington pump having a capacity of 15,000 gallons per minute, through a 16 inch main. The site finally selected for the fountain is in the center of the grand basin, opposite machinery hall, and for this location the plans of the designer were especially drawn. This site presents numerous natural advantages which have not been enjoyed by any prior fountains. When in position the fountain will be plainly observable from base to apex from almost every point on the exposition grounds. The mirror effect pro-

duced by the reflection of the fountain in the waters of the lake will also be of the most unique and beautiful description and will be a distinctive feature never before realized at any of the great expositions. Rising from the surface of the lake, the fountain structure containing the operating chamber will present the appearance of a half submerged rocky island of irregular form, having a length of 100 feet and extreme width of 50 feet.

## CORRESPONDENCE.

### New York Notes.

NEW YORK, July 27.—The electric railway men of New Jersey can hustle when there is occasion. The Brunswick Traction company, for instance, which is building a trolley line, has petitioned the various township authorities throughout the county, and ordinances in many of them have been drawn up and will doubtless soon be granted. Such an ordinance was granted at Milltown at about nine o'clock one evening recently. Everybody was in favor of it except Samuel Gordon, a farmer owning a frontage along the turnpike of 1,000 feet. He announced his intention of fighting the matter in the court. His complaint was attributed to a confusion of boundary lines, Gordon alleging that the turnpike encroached upon his property, and he wanted the matter settled before he would cease his opposition to the trolley. The trolley people were prepared, however. They had, within convenient distance all their materials, including ties, poles, bolts, spools of trolley wire and hundreds of picks and shovels. As soon as the ordinance was passed, the projectors hustled around, and within an hour had more than one hundred men employed, including expert mechanics, linemen, tracklayers and diggers, and all the materials were conveyed to this section of the road fronting Gordon's property. At midnight work was begun, and everybody was compelled to go ahead as if his life depended upon it. By noon of the next day the entire thousand feet of road was completely equipped with a trolley roadbed, ties, ballast, poles and wires. The necessity then being over, the work was relaxed and the rest of the road in Milltown Borough was finished more leisurely. Gordon, the objector, hurried to his lawyer as soon as he awoke, but it was too late to secure an injunction from Chancellor McGill, at Jersey City, and have copies served upon the officers before the work was finished. He accordingly announced that he would abandon his opposition, but the trolley people took no chances. It is said that Gordon's opposition was due to the Raritan River Railroad company.

The stock of the Pennock Electric Battery company still continues to excite discension. From Milford, Mass., comes the information that the Rev. Bryant McLellan of that place has been arrested on complaint of Purley P. Field, a retired coal dealer, for alleged fraud in the sale to Field of 100 shares of the company's stock at $5 a share, knowing that the market value was much less. Mr. McLellan was held in $800 bail. From $20,000 to $25,000 worth of Pennock stock is said to have been sold in Milford at $5 a share, while the value is quoted at the Boston Stock Exchange at 7, 8 and 10 cents a share, the par value being $1. Mr. McLellan's friends believe him innocent of intentional wrong-doing.

At a recent conference in the mayor's office in Brooklyn the matter of the speed of trolley cars was discussed, and David Young, general manager of the Consolidated Traction company of Jersey City and Newark, said that in the built-up districts on his system the rate of speed was from seven to eight miles an hour, and that in the unsettled districts it was as high as fifteen miles. He spoke highly of the fender with which the cars of the company were equipped, and said that out of 44 persons run down since November 1st only three were killed.

The directors of the Brooklyn Heights Railroad company have decided to give the Crawford fender a thorough trial on the trolley cars on its lines. The fender has been in use in Philadelphia for some time and is said to have given satisfaction. A. G.

### Washington, D. C.

WASHINGTON, July 27.—The latest news in electrical circles is the proposed electrical railroad from Washington to the battlefield at Gettysburg. It is announced positively that a company has been formed to construct such a line, and operations are expected to begin very soon. It is probable that the corporation will be headed by Governor Frank Brown of Maryland, who is also president of the Baltimore Traction company. The plan is to run a trolley road straight across country, following as far as possible the existing roads from here to the battlefield, a distance of about 75 miles. The country is a rich farming district for the entire distance, and it is thought that aside from the traffic obtained from the sight-seeing visitors to the battlegrounds, there will be a revenue of considerable size from the transportation of freight through this district, and it is expected by the projectors that the lines and their connections will cause the diversion of a great amount of garden produce into the markets of Washington and Baltimore that otherwise would find only local markets. The enterprise finds its life from a charter granted by the last Legislature of Maryland to the Maryland Immigration & Trust company, which grants the right to the corporation to "construct, equip and operate steam, electric and other railroads in the state." The right is given to it to lay tracks and use such highways, roads and streets as may be granted to it upon suitable terms by the county commissioners of any county, or by the municipal authorities of any town or city in the state, and it is expressly provided that the company shall have all such rights in the condemnation of land as are granted by the general laws of the state to railroad corporations.

Bids have been received at the Navy Department for extending the electric light plant at the Washington navy yard as follows: Royce & Marean of Washington, D. C., $3,564; Lake & Williams of New York, $3,833; E. S. Morgan of Washington, D. C., $3,945; McCoy-Howard Engineering company of Baltimore, Md., $5,690; S. D. Warfield & Co. of Baltimore, Md., $5,478. Royce & Marean are the lowest bidders and will most probably get the contract.

D. W. Holden of Alexandria, who has been the superintendent of the Mount Vernon electric railroad in Alexandria for several years, has tendered his resignation. Mr. Holden deserves the credit for putting the road in the excellent order it is now in, and his resignation is greatly regretted by the people of Alexandria, which is just across the river from Washington.

The commissioners would appear to be determined in their warfare upon the trolley poles within the city limits, and it now looks as though the trolley company had more trouble in store for it in the police court and out. The Eckington & Soldiers' Home Railroad company has been notified that it must remove without delay the poles which it has so long maintained through the center of North Capital street. The formal notice which has been served upon the company is as follows: "You are hereby notified to take down and remove within ten days from the service of this notice upon you the iron poles on North Capital street, in Washington, north of New York avenue, erected by your company. Failure to comply with this notice will subject the officers of your company to prosecution in the police court for obstructing North Capital street, between New York avenue and T street extended, by permitting said poles to remain after the time limited herein." A copy of this order has been transmitted to the superintendent of police, with the request that he notify the commissioners of a personal service of the paper upon the officers of the road.

The United States Electric Lighting company will probably wish that it had not requested permission from the commissioners to renew the four poles belonging to the company between Seventh and Ninth streets on Pennsylvania avenue. The company seeing that the poles towering high in the air were becoming old and partially unsafe, from their overloaded condition, asked permission from the commissioners to renew the poles, but, having their attention called to the existence of the poles, the commissioners not only refused permission to the company, but notified them to remove the poles entirely within the next three days, or they (the commissioners) would have them removed.

After several unsuccessful attempts, early this morning a motor car and trailer of the Metropolitan Street Railroad company's new equipment were run over the route to Tenth street and Florida avenue and return. In spite of the fact that the track was very dirty, on account of excavating and other work done beneath and on each side of it, the running was remarkably smooth. Especially was this noticed at the curves, where the motion is generally unpleasant. The stops and starts were without jar. A few more night trips will be made to drill the motormen, so that within a few days horses will no longer be seen on the Ninth street line. The successful operation of the Metropolitan line is a matter of great congratulation and pride to Washingtonians.

The absorbtion of the Chevy Chase electric railway by the Washington & Georgetown Railroad company is a fixed fact. The directors of the two corporations are now engaged in making arrangements for the transfer, and, owing to the great interests at stake, are progressing slowly. Other extensions of the Washington & Georgetown system are destined to be carried out within a short period. The Fourteenth street line, when extended, will open up a territory which has never yet been touched by any method of rapid transit. W.

### Northwestern Notations.

MINNEAPOLIS, July 27.—The overhead wire nuisance is growing worse instead of better in Minneapolis, owing to the wire inspector not enforcing the ordinance vigorously and the council committee on underground wires which has had a new ordinance under consideration for months but has not acted on it. It is charged that the electric companies instead of lowering their wires, are stringing overhead wires where it can be done without being caught. The Guaranty Messenger Dispatch company has strung overhead wires without securing a franchise. The proposed ordinance has now been referred to a joint committee, consisting of the committee on underground wires, ordinances and fire department, and assurance is given that there will be a change soon. Some of the members declare the ordinance will be passed and enforced and that all wires not in the conduits after a certain date will be cut. The companies have had numerous extensions, but have not shown any disposition to comply with the law and they say they will have to suffer the consequences.

City Assessor J. C. Plummer of Minneapolis, has decided that the franchises of private corporations and others granted by the city, will be taxed. This will include the franchises of the Twin City Rapid Transit company, the General Electric company, the International Electric company, the Dorset Subway company and the stock held in the Associated and United Press associations by daily papers. Section two, chapter three, of the tax laws of Minnesota, reads: "The capital stock and franchises of corporations and persons, except as may be otherwise provided, shall be listed and taxed.

Shawano, Wis., is taking bids for an electric light plant.

Bids are being taken by the village of Ontonagon, Mich., for an electric light plant.

The Mankato, Minn., council has ordered out all elevator and water motors by August 15th, to economize in water. The result is a scramble for other power and the water motors will be generally replaced with electric motors.

The order of the government forbidding the use of water from the Fox river for power has resulted in a shut down for the mills at Appleton, Wis., and if enforced to the letter will stop electric cars, street lights and possibly light for private consumers, until the companies can substitute steam power for water.

The Omaha Street Railway company will extend one of its electric lines to the fair grounds.

The Yankton General Electric company of Yankton, S. D., has been incorporated with $50,000 capital stock. The company will manufacture electrical supplies and furnish light and power. The light plant was one of defaulter J. T. M. Pierce's projects.

Logan, Iowa, has voted a franchise to the E. B. Hillman company of Peoria, Ill., for electric lights.

The Virginius mine at Butte, Mont., has been equipped with an electric hoist operated by a motor of 50 horse power.

Burtis & Howard of Minneapolis secured the contract for the electric light plant at Willmar, Minn., for $6,357.

The Seattle Consolidated Street Railway company of Seattle, Wash., may build a new power house.

M.

## PERSONAL.

Dr. Louis Bell, of the General Electric company, now makes his headquarters in Schenectady, having left Chicago last week. Dr. Bell, who has made an especial study of alternating current work and power transmission, will doubtless continue to make this department his specialty at the home office of the company. As a thoroughly capable engineer and a congenial companion, Dr. Bell will be greatly missed by the members of the electrical fraternity in Chicago.

## ELECTRIC LIGHTING.

The Escanaba, Mich., Lighting company has made a formal proposition offering to sell its electric light and gas plants to the city for the sum of $27,000, subject to a bonded indebtedness of $48,000, making a total of $75,000. The city is willing to pay $70,000.

George B. Kerper of Cincinnati has purchased the stock held by George P. Jones and Parks Foster in the Hancock, O., Electric Light company. The capital stock of the company is $80,000, of which Mr. Kerper owned half. Charles Smith, superintendent of the street railway company, will be superintendent of the electric light plant.

Charles Gabriel of Saginaw, Mich., is erecting an electric lighting plant in Traverse City, Mich. The rates for incandescent lamps will be, for stores, 50 cents each per month, with special rates for a large number in one place; in private houses, $18 per year for three lamps and one dollar per year for each additional lamp. The lamps will be of 16 candle power.

## ELECTRIC RAILWAYS.

It is proposed to operate an electric railroad in the streets of Little Falls, N. Y., and to build a line connecting that town with Richfield Springs.

D. B. Sweetser and A. R. Smith have been granted the right to construct an electric railway from the York Inn, in Marion, to Swayzee, Grant county, Ind.

Arrangements have been made to connect the city of Spartanburg, S. C., with several mill villages in its vicinity by an electric line. Within a few miles of the city are the towns of Glendale, Clifton, Whitney and Pacolet, each one

containing cotton factories. A company has been formed, which includes George S. Tenney, a New York contractor, and A. L. Leftwich, of Baltimore. The company will control the gas and electric light plant of the city, and add 300 horse power to it. The road will be at first ten miles long, to be increased later by branches. It will be equipped with fifty horse power motors, and carry freight as well as passengers.

A dispatch from Bridgeport, Conn., July 23d, says: By order of the Common Council, City Attorney Toomey, recently appointed by Mayor Clark, to-day commenced an investigation into the manner in which the Traction company constructed its lines a year ago. Ex-City Attorney Davenport has charged that the Traction company did not construct one rod of the road in compliance with the specifications; that inferior material was used, and the work done in a way which saved the company many thousands of dollars. This was accomplished, it is alleged, by employing members of the streets and sidewalks committee of the Common Council to do work of various kinds for the company.

Final arrangements have been perfected by the Lake Street Elevated Railroad company of Chicago for the use of electricity instead of steam as the propelling power of the road. The third rail system will be used. "The matter was decided some time ago," said President D. H. Louderback, "and the third rail will be somewhat similar to that in use on the Metropolitan 'L.' A number of cars will be remodeled to make room for the motormen. The General Electric company will furnish the apparatus to be used in the cars and the Illinois Steel company will furnish the steel rails." It is said that a great deal of discussion was indulged in before the company finally determined to use the third rail system, which was considered objectionable on account of the liability to accidents, but the electricians promised certain improvements which would make accidents less likely to occur, and on this assurance the company decided to adopt it.

For the year ended June 30, 1895, the Binghamton, N. Y., Railroad company reports receipts of $127,483.61; operating expenses, $73,716.48; net earnings from operation, $50,519.73. President G. T. Rogers says: "The Binghamton Railroad company, organized under the laws of the state of New York, is the outgrowth of the consolidation of all the street railroads of this city. Since submitting my last annual report, issued July 1, 1894, the road has shown the remarkable gain in gross earnings of 17 per cent., and a gain in net earnings from operation, including taxes, of 23 per cent. The percentage of operating expenses to earnings for the past year was 57⅝ per cent. These results have been accomplished with the same trackage, under the same conditions and in the face of the prevailing financial depression and the most severe winter the road ever experienced. After paying interest on funded debt amounting to $31,500, there remains a dividend upon the capital stock of over 5 per cent. This amount in our surplus account, taken together with the 20 per cent. in stock dividends declared during the past five years of the present management, should prove satisfactory to the stockholders."

## TELEGRAPH.

Advices have been received at Washington that Japan is extremely anxious for the construction of a cable between the United States and that empire. The announcement is made that the imperial government will grant a liberal subsidy to any company which will undertake the construction and maintenance of such an interoceanic cable connecting the American Pacific coast with the islands composing the Japanese empire.

The crew of the cable steamer Mackaye-Bennett, which is stationed at Halifax, N. S., and looks after the cables of the Commercial Cable company, held a regatta in Halifax harbor July 22d. The races were confined exclusively to the ship's company, and comprised rowing and sailing matches, sculling in tubs, etc., for prizes presented by their employers, while on shore various sports and amusements were provided for Jack and his friends, and they were entertained in a very hearty manner. An excellent band of music was provided for the occasion. George G. Ward, the vice-president of the company, and S. S. Dickenson, superintendent of the Canso station, were present, and assisted Captain Schenck in carrying out the arrangements. Many prominent Halifax people were spectators.

An amusing story is told in an English journal about the construction of a telegraph line from Bagdad, in Asia Minor, to the Persian capital of Teheran. The frontier line between Turkey and Persia was so indefinable that a tract of no less than 17 miles of land over which the telegraph would have to be carried was in dispute, each of the two countries claiming the right to its possession. Now the engineering stores supplied to the Turkish government differed from those supplied to the Persian government. The former had wooden telegraph poles; the latter iron ones. The Persian government, in its jealous hatred of the Turks, feared that if the wooden poles were erected across the disputed territory, posterity would regard them as proof that the territory was Turkish. On the other hand, the Turks objected to iron poles being used, lest in the far future they should be adduced by Persia as evidence that the land was hers. The way the superintendent of the work contrived to get out of the difficulty did credit to his ingenuity and resource. He set up first a wooden pole, and then an iron one, then another wooden, then an iron again, and so on, alternating wood and iron for the whole 17 miles.

## POWER TRANSMISSION.

Electricity generated by the falls of the American river at Folsom was transmitted to Sacramento, 24 miles away, on July 15th. Only the big plant at Niagara Falls is larger than that of Folsom, but the transmission to Buffalo is shorter. The waters of the American river, which have been running to waste, will now be utilized for lighting Sacramento's streets, propelling her cars and operating her factories. Years have been spent upon the work. An immense masonry dam was thrown across the American river at Folsom, creating a reservoir three miles long, and furnishing a flow of 85,000 cubic feet per minute. The water, after passing through four horizontal shaft double-turbine wheels, is used for irrigation purposes, and 300,000 acres of land will be supplied. The turbine wheels are 30 inches in diameter, and under a head of 55 feet develop 1,300 horse power each. The shafts of the wheels are coupled direct to the shafts of four three-phase alternating current generators of the General Electric type, each capable of developing 1,000 horse power. These dynamos weigh about 40 tons each. Step-up transformers raise the voltage to 10,000 volts, and it is then transmitted by overhead copper wires to the city. Two separate lines have been built as a precaution against accident or shut-downs for repairs. One line will always be held in reserve. It is calculated that 80 per cent. of the electric power generated at Folsom will be transmitted 24 miles to Sacramento.

## MISCELLANEOUS.

Business men of Milwaukee avenue, Chicago, have appointed a committee to confer with the commissioner of public works in relation to the scheme of burying all wires on the street.

The Westinghouse Electric & Manufacturing company will soon begin the drilling of a well for natural gas on the land in front of the new works at Brinton, Pa. The drill will be operated by electricity. An ordinary street car motor will be placed in the engine house, instead of a steam engine, and the current will be supplied from the new plant.

Prof. H. W. Vanell wants the county commissioners of Chicago to give him the opportunity of treating insane patients. He has written a letter to President Healy in which he says that those who are now treating the insane patients are depending upon books with the opinions of others and without originality. Electricity, he says, is the cure for insanity, and he wishes to try it on the patients at Dunning.

A stock company is being organized at Waco, Tex., to operate electric launches on the streams of Central Texas on a plan which the projectors believe will be practical and profitable without any improvement whatever to the water courses to be navigated. The boats to be used, it is said, will take 2,000 pounds smoothly in 18 inches of water, and over that depth is maintained the year round in many of the rivers and streams.

A new invention, which promises to become valuable in the manufacture of steel, has been tested at the Homestead Steel Works and proved successful. The test consists of a new plan which Manager Schwab and Chief Electrician Hinkey have evolved by reheating molten metal that has become chilled before being poured into the moulds, causing delay and loss. It consists, essentially, in forcing an electric current into the mass, by which an intense heat is generated. The steel was set to bubbling, and the heat was so intense that the workmen's eyes seriously suffered.

The Germans have been discussing their indebtedness to American electrical inventors. In a spirit of scientific fairness the *Elektrotechnische Zeitschrift* has pointed out that central station work, as at present understood, was originally indebted for its development to American inventors. The *Vossische Zeitung*, in a patriotic outburst, attacked the *Elektrotechnische Zeitschrift* for this. The editor of the *Elektrotechnische Zeitschrift* then wrote explaining matters to the *Vossische Zeitung*. The latter paper garbled this letter, only printing detached portions of it. Then the *Elektrotechnische Zeitschrift* printed its own letter in full in its own pages, and other papers took the matter up.

## TRADE NEWS.

The Standard Telephone & Electric company of Madison, Wis., is making an earnest effort to extend its business throughout the entire country and is bringing to the attention of prospective investors the merits of its instruments and construction work. The company is sending out a new catalogue that is complete and interesting. In a circular letter of July 15th the company says that it is supplying railways with telephones for private lines in place of the Bell and others, and is supplying new exchanges both great and small. It is now supplying exchanges, from a dozen to as many as 600 subscribers. The Standard telephone is especially recommended for long-distance and exchange work. It has been tested over many hundreds of miles of telegraph wires, where dozens of relays were at work, and its work was pronounced perfect.

## BUSINESS.

The fifth edition of "Charlie" Gregory's vest-pocket electrical directory of Chicago is out. The little book is certainly a great convenience, and it is highly appreciated by all recipients.

The Swarts Metal Refining company of 120 West Lake street, Chicago, has issued a catalogue and price-list of the babbitt metal, spelter, solder, lead, tin and antimony which it produces. The company, which also handles cotton waste and leather and rubber belting, prides itself on the high grade of its goods.

The Columbian Corliss engines of the Lane & Bodley company of Cincinnati are described in a recent pamphlet. These engines are said to fully meet the demand for that type of the steam engine which shall perform a varying quantity of work, with a high degree of economy, and which shall give a practically uniform rate of speed under varying loads and steam pressures.

The A. W. Harris Oil company of Providence, R. I., widely known for its high grade valve and cylinder oils, whose former Chicago office was at 55 and 57 South Canal street, has again entered the western field. The new office is at 1325 Monadnock building, and the company has installed as manager Urban W. Frink, who is well and widely known in the West. The selection is a good one, as it had to be to replace Ben Terry, who now looks after the eastern end of the business of this popular firm. The WESTERN ELECTRICIAN wishes the Harris company success and is glad to welcome it back again.

The Michigan Electric company of Detroit has recently completed an arrangement with the General Electric company and the Edison Illuminating company of Detroit, covering the selling agency of General Electric machinery and supplies in Michigan, and consequently the General Electric company will at once close its office in Detroit. This arrangement covers the entire line of General Electric manufactures, including lighting generators, motors and incandescent lamps. The Michigan company, which was incorporated about 2½ years ago, has grown rapidly until today it is one of the largest and best equipped supply houses in the country, and is making itself felt as a strong competitor for the supply business. The arrangement with the General Electric company is one on which both parties thereto are to be congratulated, and it will undoubtedly result in the General Electric company obtaining a good share of the business in Michigan. The Michigan company has, however, made an exception in the matter of overhead railway material, in which line it will continue to manufacture and sell the "Michigan" hangers, etc., which have obtained a most satisfactory recognition among the street railway companies, and have proved to be just what was claimed for them, viz., the simplest, strongest, and most practical overhead devices made. The Michigan company has recently engaged H. E. Baldwin, formerly representing the General Electric company in Kansas, Missouri and Oklahoma, who will look after the state trade, and L. J. Baldwin will hereafter be in charge of the sales at the company's headquarters.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued July 23, 1895.*

542,982. Producing Pure Electric Light Carbon. Edward G. Acheson, Monongahela City, Pa. Application filed August 25, 1894.

The method consists in granulating coke, and subjecting it to the required degree of temperature necessary to volatilize the impurities associated with it.

542,986. Electrode-depositing Device. John Bossard, Dubuque, Ia. Application filed November 11, 1893.

The arrangement consists of a tank and depositing bath, a bridge over the tank hooks from which the articles are suspended, electric connections between the bridge and hooks, an endless belt traveling outside of the bath and engaging with the hooks, by means of which the articles are automatically drawn through the bath, and means for imparting an intermittent motion to the belt while drawing the articles through the bath.

543,000. Electrical Time Annunciator. Edward M. Edgerton, Chicago, Ill. Application filed February 12, 1892.

The combination includes an electric circuit, clockwork, an anulus, an arm, switchboard and brushes, a switch bar normally connecting the brushes, which constitutes the terminals of a break in the circuit, a magnet, an auxiliary electric circuit, and a push-button for closing the auxiliary circuit, thereby vitalizing the magnet and causing the release of the switch bar, so as to open the main circuit.

543,003. Electro-medical Apparatus. Jacob R. Etter, Crawfordsville, Ind. Application filed June 19, 1893.

There is the combination in a switchboard of the switch points, the metallic connections, and the switch levers, comprising a battery lever, a double galvanic lever, a single galvanic lever, a selecting lever, a controlling lever, a pole-changing lever, and a cautery lever, for the purpose of regulating and minutely controlling the electric currents.

543,016. Incandescent Lamp Socket. Edgar H. Heath, Grand Rapids, Mich. Application filed March 21, 1895.

In this socket there are a screw or stud in the axis of the socket, and adapted to engage the inner electrode of the lamp, a lever pivoted on the screw and extending outside the socket, a spring electrode engaging the lever when the circuit is closed, and electric circuits from the outer electrode of the lamp and from the spring electrode to the main circuit.

543,042. Trolley Wheel. Charles Mitchell, Yonkers, N. Y. Application filed December 20, 1894.

The side bearing frames, the wheel having opposite axle projections, and spaces beyond the ends of the axle projections, contact balls arranged in the spaces in contact with the ends of the axle projections, and side contact plates attached to the side-bearing frames and fitting over the spaces in contact with the contact balls therein.

543,055. Secondary Battery Plate. John J. Rooney, Brooklyn, N. Y. Application filed November 19, 1894.

As shown in the cut, there are a perforated base plate and perforated coating plates, the perforations in the coating plates being smaller than those in the base plate, the plates being united with their perforations registering concentrically to form a grid, having openings therethrough, and pockets surrounding the openings, and active material or material to become active packed in the pockets and openings of the grid.

543,065. Electrically Controlled Voting Machine. Charles A. Stitzer, Central City, Neb. Application filed November 27, 1893.

There are a plurality of registering devices and locking mechanism adapted to lock each of the registers against opera-

tion, an electric circuit controlling the locking mechanism, and contact devices in the circuit arranged to open and close the same, and means actuated by each of the registers for operating the contact lever.

543,089. Meter for Alternating Electric Currents. Ludwig Gutmann, Pittsburg, Pa. Application filed May 20, 1890.

Two or more stationary energizing coils, an armature whose windings lie in different planes rigidly mounted on a shaft adapted to rotate, and fans, and a registering train.

543,106. Village Telephone System. Charles E. Scribner, Chicago, Ill. Application filed July 2, 1886.

Telephone lines extend to several stations, each station including an outfit consisting of a telephone set, a bell and loop switch, the loop switch normally bringing the bell into the circuit of the particular line of the station, in combination with a looping device connected with the bell and its switch at each station, whereby the bell of any station may be temporarily included in the circuit of any line of the station other than the one in which the bell is normally included.

543,160. Telephone Exchange. Wada Y. Shibata, San Francisco, Cal. Application filed October 11, 1894.

In a telephone exchange system, the circuit-breaking coil, the movable armatures with the holding springs, and adjusting screw in combination with the movable projecting strips and the magnet, and lever arms, whereby the strips are alternately moved to cover the contact surfaces or expose them.

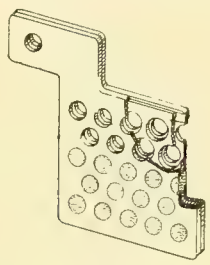
543,186. Carbon Holder. John C. Knight, New York, N. Y. Application filed January 15, 1895.

As shown in the accompanying cut, this device consists of a socket provided with means for securing it to the rod or frame of a lamp, with dust discharge openings at its bottom, and set-screws extending through bosses located on the walls of the socket at 120 degrees apart, two of which screws are adapted to be set for a particular size of carbon, while the third is in the form of a thumb-screw for frequent manipulation.

543,190. Art of Telephoning. Arthur E. Paige, Philadelphia, Pa. Application filed February 25, 1895.

The improvement described consists in disturbing by means of sound vibrations, and in conformity therewith, a liquid conductor interposed and supported between two separated electrodes without varying the position of the electrodes relatively to one another, the electrodes and interposed conductor constituting a part of a telephone circuit.

543,198. Electric Current Distributer. Elihu Thomson, Swampscott, and Edwin W. Rice, Jr., Lynn, Mass. Application filed October 13, 1892.



NO. 543,055.

The cut shows the arrangement in an electric circuit, including the combination of an electro-magnetic coil subject to overheating under abnormal conditions, a fusible material arranged to receive heat from the coil when overheated, and serving to retain the circuit controller in its normal position during normal work in the coil, and means for causing the operation of the circuit controller on the softening or melting of the fusible material owing to the heat accumulated in the coil.

543,223. Alternating Electric Motor. Joseph A. G. Trudau, Ottawa, Can. Application filed April 6, 1894.

In an electro-motor there is claimed the combination with suitable field magnets, of a rotatable armature having a circumferential iron hoop and a non-magnetic central portion, and an energizing coil encompassing the armature, and having its outer folds within the inner circumference of the hoop, whereby that portion of the hoop outside the coil will be of one polarity through its entire thickness.

543,231. Writing Telegraph. Thomas Ewing, Jr., Yonkers, N. Y. Application filed January 9, 1894.

One claim follows: In a writing telegraph the combination at a transmitter station of devices for sending to line two sets of currents, and means for returning to its neutral position the device for sending one of the sets of currents upon each operation of the device for sending the other set of currents.

543,241. Writing Telegraph. William E. Gump, Brooklyn, N. Y. Application filed February 24, 1894.

There is the combination of a shaft, means for revolving it, a friction arm, a contact bearer pivoted thereto intermediately with respect to its contact members, and one or more pairs of contacts closed by movement of the friction arm and contact bearer.

543,243. Electric Arc Lamp. Daniel Higham, Boston, Mass. Application filed May 2, 1895.

An electric arc lamp is described, having electric arcs connected in series, suitable feeding mechanism provided with series magnet windings controlling the same to regulate the current at the desired or normal amount and means whereby the normal lengths of the arcs are maintained by the heat given out by the arcs.

543,249. Process of Refining Sugar by Electrolysis. Emile Javaux and Charles F. Gallois, Paris, France. Application filed May 26, 1894.

The process described for the purification of sugar juices consists in adding lime in excess, to neutralize the acid constituents, precipitate the organic impurities, and prevent the formation of salts of lead, then treating the alkaline juice by an electric current introduced from anodes of lead in two separate tanks simultaneously, and drawing the juice from one tank into the other, during the treatment.

543,271. Trolley Stand and Pole. Lawrence C. Seelye, Fort Edward, N. Y. Application filed January 2, 1895.

This is a vertically extensible trolley pole, the trolley carried at the upper end thereof, and a device actuated by the upward extension of the trolley pole to pull the pole over.

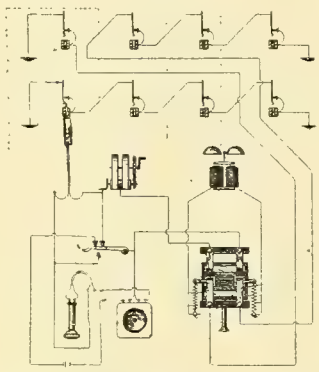
543,280. Incandescent Electric Lamp. George Westinghouse, Jr., Pittsburg, Pa. Application filed August 29, 1892.

This invention comprises an incandescent lamp socket having integral leaf springs, the free ends of which extend inwardly toward the base of the socket and are provided with bends for engagement with a flange on the neck of the lamp bulb.

543,313. Telephone Transmitter. Zorah E. Patrick, Chicago, Ill. Application filed January 18, 1895.

This device consists of a hollow vibratory shell, a body of variable resistance mounted rigidly upon the side walls of the shells, and an electric circuit passing through the body of variable resistance, the shell serving to support the body of variable resistance, and transmit modified mechanical vibrations thereto, but being wholly without the electric circuit.

543,328. Telephone Attachment. Charles E. Bertels, Wilkesbarre, Pa. Application filed March 20, 1895.



NO. 543,106.

An attachment for supporting a telephone receiver, comprising two pivoted arms having a hinged connection with each other and with a stationary wall bracket or support, a clamping arm swiveled to the end of the outer pivoted arm so as to be capable of being revolved relatively thereto and adapted to receive and hold a telephone receiver, and a set screw carried by clamping arm for holding it at the desired angle.

543,336. Electric Registering Apparatus. Alphons Custodis, Dusseldorf, Germany. Application filed March 19, 1895.

It is composed of a vessel, an inclosed suspended movable contact, a pair of coils of which one is connected to the contact and the other to a fixed resistance, a pointer controlled by the coil-cores and a battery.

543,346. Electric Transformer. John A. Mosher, Chicago, Ill. Application filed May 7, 1895.

The features of this invention are a block for attachment of the terminals of the primary coil and the main circuit, a contact plug for completing the circuit by connecting both wires of the main circuit with the primary coil, the medium of transmission through the plug being fusible.

543,351. Electric Brake. William B. Potter, Schenectady, N. Y. Application filed March 23, 1895.

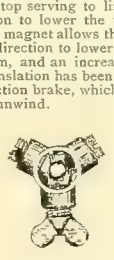
As a means for arresting a moving vehicle, a normally idle dynamo-electric generator is provided, together with braking apparatus, means for imparting an initial magnetization to the generator, a local circuit, and means for including the generator in the local circuit with the braking apparatus.

543,352. Safety Appliance for Electric Cars. William B. Potter, Schenectady, N. Y. Application filed April 9, 1895.

In an electrically propelled vehicle there are a controller, a plurality of motors operating the vehicle, and a switch in the controller provided with contacts and connections adapted to reverse the relation of armature and field in the motors and to throw them upon independent short circuits, in whichever direction the vehicle may be moving.

543,355. Electric Arc Lamp. Henry J. Sage, Chicago, Ill. Application filed Feburuary 13, 1895.

A regulating magnet placed in a shunt circuit, a lever actuated by the magnet, a friction brake operated by the lever, a drum around which a ribbon supporting the upper carbon is wound, the drum being capable of a bodily translation as well as rotation, the friction brake operating upon the drum and serving to sustain it in a position which corresponds to an elevated position of the upper carbon and at the same time prevent its rotation, a stop serving to limit the movement of the drum in the direction to lower the upper carbon, whereby a current through the magnet allows the friction brake and drum to be moved in the direction to lower the upper carbon without rotation of the drum, and an increase in the current strength after the drum's translation has been stopped allows a further movement of the friction brake, which reduces the friction and allows the drum to unwind.



NO. 543,186.

543,357. Electric Transportation System. Richard E. Sherman, Chicago, Ill. Application filed March 1, 1895.

In an overhead electric system of mail transportation, the outgoing and return circuit lines are supported one above the other on posts. Other features are a mail-bag receptacle, a metallic frame supporting the receptacle, a driving contact wheel on a shaft carried by the frame and by which the frame is suspended on one of the lines, an electric motor on the frame and insulated therefrom and from the receptacle and having its armature shaft geared with the contact wheel, an extension of the frame carrying vertical guide rods, a second spring-controlled contact wheel journaled to bear against the other of the lines on a shaft, having guide sockets surrounding the rods, an electrical connection through the motor between the contact wheels, and a switch in the connection.

543,358. Electric Clock-winding Mechanism. Louis H. Spellier, Philadelphia, Pa. Application filed May 28, 1891.

The actuator or actuating mechanism of a clock, an electric motor and a device supplementing the action thereof and set in motion thereby, such device continuing to wind the spring or other actuating mechanism of the clock, after the electric motor has ceased to act.

543,364. Testing Circuit for Alternating Current Systems of Distribution. Herbert C. Wirt, Schenectady, N. Y. Application filed April 13, 1895.

The means for testing transformer leakage in an alternating current system of distribution comprise mains, transformers having their primaries in multiple arc across the mains, leads from the secondaries of such transformers, including a galvanometer or current indicating device and a source of electromotive force, and means for connecting the leads to one or the other of the mains.

543,372. Secondary Battery. Emil Boettcher, Leipsic, Germany. Application filed May 12, 1890.

A battery containing a zinc oxide solution, a zinc cathode and a non-conducting covering that extends over the lower surface, the rim and the vertical stem of the cathode.

543,382. Electric Railway System. John C. Henry, Westfield, N. J. Application filed May 13, 1895.

A system of current distribution is described, having sources of supply of different electromotive force coupled together in the three-wire or compensating system, one or more road conductors divided into electrically separate sections, and conductors leading from the coupled sources of supply to different sections of the road, whereby predetermined sections will be given different voltages.

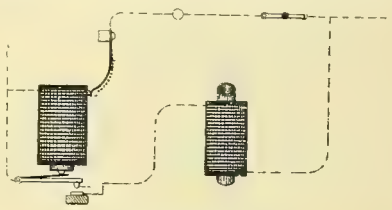
543,383. Dynamo-electric Machine. Thomas H. Hicks, Detroit, Mich. Application filed January 13, 1894.

In an electric machine there is a commutator constructed with annular grooves toward the extremities of the commutator, wire bands located in the grooves and insulated from the commutator segments, and rings located upon the wire bands.

543,399. Electric Arc Lamp. Samuel E. Nutting, Oak Park, Ill. Application filed October 5, 1894.

A device is actuated by heat from an electric current passing through the lamp; there are also a brake wheel suitably mounted upon its shaft, a swinging frame, a brake pivoted in the swinging frame and adapted to engage with the brake wheel, means adapted to communicate the action of the heat device to the brake, and a shunt circuit around the arc adapted to move an independent trip and release the brake from the brake wheel.

543,409. Electrical Switch. Henry Stuebner, Philadelphia, Pa. Application filed January 19, 1895.



NO. 543,198.

Two reciprocating push rods, a block provided with seats for the push rods and having a hub, in combination with a spring coiled about the hub and having its ends in direct engagement with the push rods.

543,425. Writing Telegraph. James H. Robertson, Brooklyn, N. Y. Application filed January 9, 1894.

In a two-wire writing telegraph system there is the combination of a suitable receiving device at a receiver station, two wires joining the stations, and at the transmitter station means for transmitting over the two lines currents which effect the movements of the receiving pen in extent and intervening currents of both polarities which control the direction of its movements.

543,426. Writing Telegraph. James H. Robertson, Brooklyn, N. Y. Application filed December 19, 1894.

The receiver and transmitter, and electrical connection between the same, a pen lifting and lowering mechanism, and an induced current generating mechanism arranged to operate through the electrical connection, the pen lifting and lowering mechanism.

543,427. Writing Telegraph. James H. Robertson, Brooklyn, N. Y. Application filed March 21, 1895.

The method of transmitting the perpendicular movements of writing over the same main lines that transmit the lateral movements of writing is described, consisting in disconnecting the terminals of two main line wires at the transmitter and cutting off the common ground and batteries, and then inserting for an instant between the main line wire terminals a battery of greater power than either of the individual batteries on the main lines.

543,428. Writing Telegraph. James H. Robertson, Brooklyn, N. Y. Application filed March 21, 1895.

This invention covers the combination of a transmitter pen and mechanism operated thereby for controlling the connection to line, comprising a circuit interrupter for controlling the connection to line, and a contact maker for connecting the line up through a resistance or around the same, according to the direction of movement of the transmitter pen.

543,429. Writing Telegraph. James H. Robertson, Brooklyn, N. Y. Application filed March 21, 1895.

A resistance through which the writing impulses are sent, in combination with a friction contact adapted to send an impulse direct to line when the movement of the transmitting pen is reversed and the resistance is cut out.

543,435. Means for Arresting Motion of Electric Cars. Arthur K. Bonta, Hoboken, N. J. Application filed March 21, 1895.

Two propelling motors, a controller stand located on the motorman's platform, the controller stand containing two circuit changing cylinders; one for reversing, and one for varying the speed, a short-circuit including both motors in series, a circuit controller for the short-circuit, located upon the reversing cylinder, and a lever for operating the reversing cylinder, the lever having two stops, one of which is adjustable.

543,445. Electric Arc Lamp. William Jandus, Cleveland, O. Application filed December 19, 1894.

In an arc electric lamp there is claimed the combination with an arc inclosing globe of a cap provided with a tube and a floor, and a washer seated upon the floor and having a lateral adjustment thereon.

# Western Electrician.

EVERY SATURDAY.

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## Municipal Lighting Plant at Hawarden, Iowa.

During the last year there was completed in the city of Hawarden, Iowa, an electric lighting plant controlled by the municipal government and supplying street and commercial lighting. Those in charge of the work believe that the first cost was exceedingly low, especially when the excellent character of the work is taken into consideration. This is explained by the fact that the city was prepared to pay cash for the equipment, a condition not often met with these days, and the competition was unusually keen. Then, too, the contracts were placed during a season of unprecedented business depression. The cost of the plant, aside from the real estate, was $12,000. Other points of special interest about this plant are its compactness, the use of a Corliss engine belted directly to an alternator, the mechanical and electrical efficiency of the apparatus; also the income and cost of operation.

The plant was installed under the supervision of William H. Bryan of St. Louis, who prepared the plans and represented the city throughout the transaction. The steam plant consists of two 54 inch by 18 foot steel boilers, set separately, each boiler having 38 four-inch tubes. The engine is a Sioux City Corliss, 12 by 30, speeded at 105 revolutions per minute. A Worthington boiler feed pump and Hoppes heater complete the steam equipment. The city water works pump, used principally for fire protection, is operated from the same plant. The electrical equipment consists of a 36 kilowatt Thomson-Houston alternator, speeded at 750 revolutions per minute. The relatively high engine and low alternator speeds make it possible to belt directly, the engine running "under." Double the usual weight was put in the rim of the engine fly-wheel, and this arrangement insures a very satisfactory light, free from pulsations. Space has been left to duplicate the engine and dynamo capacity.

The distribution is on the basis of 1,000 volts pressure, 1,050 and 1,100 volts being maintained at the switchboard. The entire distribution is through only thirteen converter-groups or sub-stations, the converters having a total rated capacity of 744 lights and the number of customers per group varying from one to 26. This makes it possible to greatly overload the converters.

Approximately 1,000 16 candle power indoor lights have been connected and fifty 32 candle power street lights. The latter are arranged in five groups of 10 each, with a shunt coil for each lamp. They are hung in the center of street intersections by the cross suspension method. Switches are provided to throw the street lights on or off from the station as desired. The plant is run all night every night, but the street lights are cut out when the moon is shining.

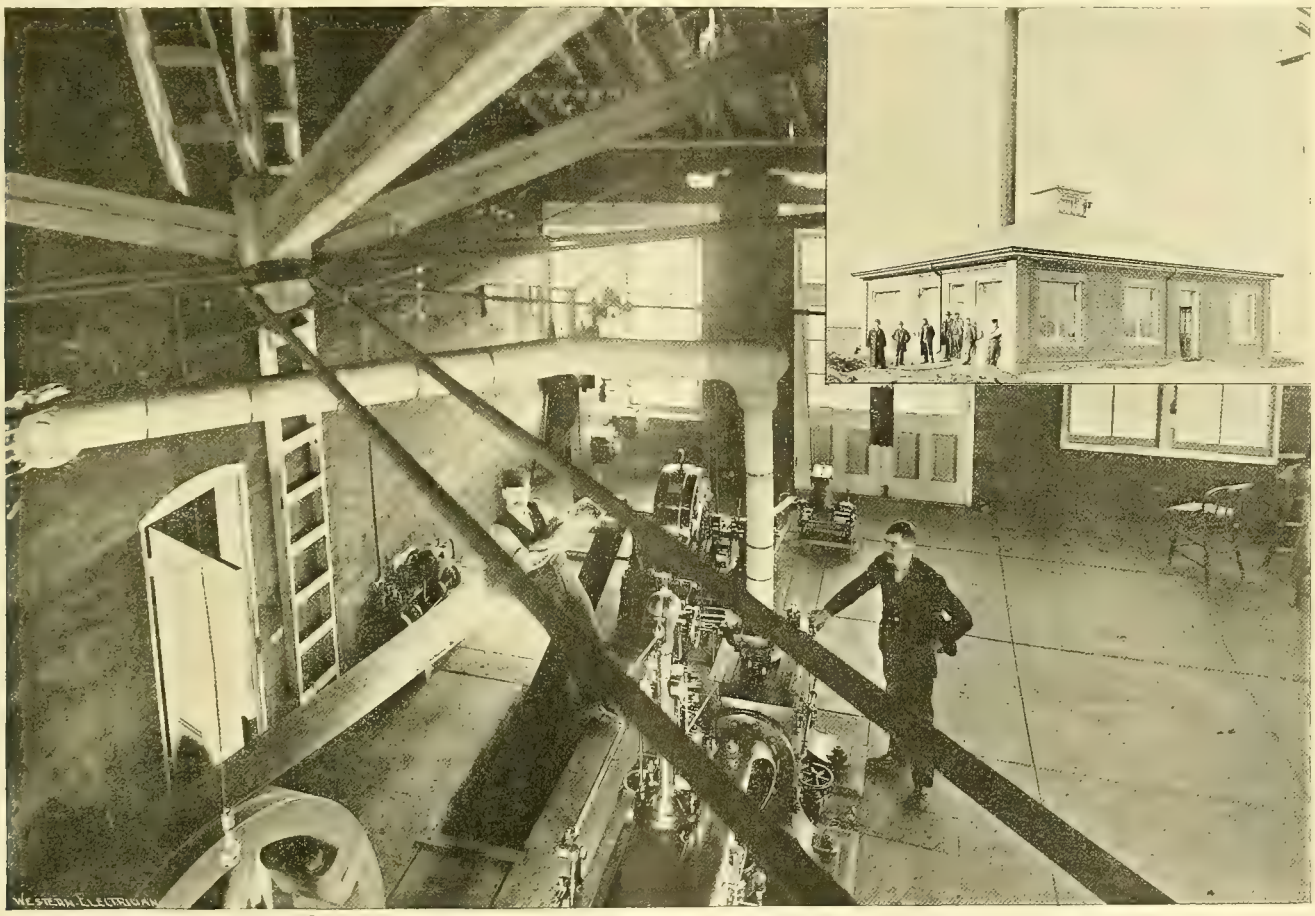

FIG. 1. MUNICIPAL LIGHTING PLANT AT HAWARDEN, IOWA.—DYNAMO AND ENGINE ROOM, AND EXTERIOR VIEW OF POWER HOUSE.

About half the commercial lights are on meters, the rate being ¾ cents per hour, per 16 candle power lamp, for business lights, and 1 cent for residence—a reasonable minimum being provided.

On December 12, 1894, an efficiency test was conducted by the consulting engineer with the following results, which he considered quite satisfactory considering the size of the plant and the service required of it:

| | |
|---|---|
| Friction of engine and dynamo, unloaded, at 100 revolutions | 10.03 horse power |
| Friction of engine and dynamo, unloaded, at 109 revolutions (computed) | 10.93 horse power |
| Total load with an output of 36½ amperes | 68.67 horse power |
| Electrical output of dynamo, at the same time | 53.82 horse power |
| Net power required to drive dynamo | 57.74 horse power |
| Efficiency of dynamo | 93.2 per cent. |
| Efficiency of plant from engine to switchboard | 78.4 per cent. |
| Percentage of total power required to drive friction load | 15.9 |

An excellent idea of the arrangement of the apparatus and the general appearance of the plant will be gained from reference to the accompanying illustrations. The cut on this page, Fig. 1, shows the interior of the dynamo and engine room and in the upper right hand corner of the plate is an exterior view of the power house. Fig. 2 is a general floor plan of the plant, showing the arrangement of the apparatus. The plant is laid out with a view of securing economy of operation and making it unnecessary to employ a large number of hands. Altogether it is certainly a very creditable installation.

The plant as a whole is reported as giving the best of satisfaction. It has never lost a minute since starting into regular service on December 15th. F. E. Watkins, cashier of the First National Bank of Hawarden, was mayor at the time. J. H. Winchel, Le Mars, Iowa, was the contractor for the steam and electrical equipment, and F. J. Swanson was and is still chief engineer in charge of the plant.

## Lightning and Barns.

Mr. McAdie's pamphlet on "Protection from Lightning" has been revised and republished. Among the additions made to the old material is a discussion of the question whether barns are any more liable to be struck by lightning after being filled than before. Mr. McAdie cites these figures: Last year, prior to August 1st, 223 persons were reported as killed by lightning in this country; after that date, 113; dwellings struck, before August 1st, 173; after, 87; churches, before, 10; after, 15; barns, before, 130; after, 138. It thus appears that while much more than half the year's damage done by lightning in other directions occurred prior to the date mentioned, a trifle more than half the injury to barns from that cause came afterward. Mr. McAdie mentions three possible reasons for this increased peril after harvesting the crops: (1) The stalks of grass and growing grain serve as tiny lightning rods, and relieve the electric strain between sky and earth, but when they have been cut down only the buildings and trees are left to serve that purpose; (2) a full barn is warmer, and hence more readily ignited than an empty one; and (3) the vapor in the warm air, rising from a barn filled with new hay, attracts the electric current and invites a discharge by that route.

## Properties of Fuse Metals When Subjected to Short-circuits.[1]

By Walter E. Harrington.

In the transactions of the Institute, May 1893, page 251, is a paper by Charles P. Matthews, "On the Behavior of Fuse Metals in Direct and Alternate Current Circuits." The paper deals quite exhaustively with the law established by Preece, Prof. Forbes and others, bearing on the relation existing between the diameter of fuse metals and the minimum currents required to fuse the metals, when sufficient time elapses for the fusion to occur.

The law as enunciated is $C = a\, d^{\frac{3}{2}}$ wherein

C = Current in amperes,

d = Diameter of wire in inches,

a = Constant depending on the metal.

The law is not rigorously true, but can be depended upon very closely, particularly in the smaller diameters. In the larger diameters the law certainly does not hold true, as has been shown by different observers.

To be true and express the real relation, the constant *a* should be expressed as a function of *d*; and as far as my observation has led me, I think *a* is a linear function of *d*.

On page 261 of Mr. Matthews' paper is briefly mentioned that fuse metals rarely fuse in practice under the conditions that the law as obtained demand. Mr. Preece, on short-circuit tests made by him, writes in a very vague manner covering the results obtained.

In the course of his professional work the writer has had occasion frequently to desire to know what current would flow through fuse metals on 500 volt short-circuit work. There being absolutely no literature on the subject and the data being obtained only by experiment, led to the following series of tests.

The tests were conducted in the power station of the Camden Horse Railroad company, Camden, N. J., during August, 1894. The testing room was about 30 feet away from the bus bars of the main station switchboard. No. 2 B. & S. gauge copper wires led from the bus bars to the testing table. At the switchboard the two leads were connected, one to the ground bus bar direct, the other through a 100 ampere knife-blade switch to the trolley side of a Westinghouse magnetic circuit breaker, whose range of adjustment was from 250 amperes to 500 amperes in 50 ampere steps. In the testing room the wires were arranged diagrammatically, as shown in Fig. 1. In the cut, *A* was a special fuse block whose terminals were protected by oil, leaving three inches of fuse in the atmosphere; *B*, fuse metal whose fusing current on short-circuit was to be determined; *C*, a C-S magnetic circuit breaker carefully calibrated throughout its range, not only for its adjustment, but also as well for 7, 14, 20, 30 and 40 turn coils. A Weston standardized ammeter was employed during calibration. Since the construction of the C-S magnetic circuit breaker is such that the adjustment depends only on weight and distance, the circuit breaker does not vary after use. *D* is a 100 ampere knife-blade switch.

The fuse metals tested were placed in fuse block *A* and switch *D* thrown. This was repeated with the same size fuse metal a sufficient number of times to find the adjustment of the C-S magnetic circuit breaker which the current flowing would not open, also the adjustment at which the current flowing would open. The current which actually flowed would be somewhere between the two indications as obtained. The accompanying tables give the mean of the two readings. The tests were made during the middle of the day when the loads were light on the power station. A 200 kilowatt General Electric four-pole and a 100 kilowatt Edison bipolar generator were running during the obtaining of the following data.

The sizes of fuse wires employed were such that the current flowing through them would not exceed 500 amperes, this being determined by the adjustment of the Westinghouse magnetic circuit breaker referred to before.

In the following tables the first column gives the size of wire in B. & S. gauge; the second column gives the circular mils. The third column gives the mean of determinations as given by the indications of the C-S magnetic circuit breaker. The fourth column gives the constant B entering into the formula $C = B\, d^2$, where

C = current in amperes passing through the fuse metal on a short-circuit.

d = diameter of fuse metal in inches.

B = constant depending on metal and voltage of circuit short-circuit is made on.

The writer noticed that the values as obtained in the tests when compared with the circular mils of the wires tested showed a very close proportionality, showing that the fusing currents on short-circuits followed the law of the square times a constant.

TABLE I.—COPPER.

| B. & S. Size Gauge. | d² C. M. | S. C. Amperes. | B. |
|---|---|---|---|
| 30 | 100 | 39 | 380,000 |
| 29 | 126 | 44 | 350,000 |
| 28 | 159 | 62 | 390,000 |
| 27 | 201 | 80 | 398,000 |
| 26 | 254 | 116 | 456,000 |
| 25 | 320 | 140 | 437,000 |
| 24 | 404 | 225 | 556,000 |
| 23 | 509 | 300 | 589,000 |
| 22 | 642 | 370 | 576,000 |

Table I. is for copper. While the constants B vary, especially as the sizes of the wire become larger, this variation is probably due to possible changes of conditions, such as differences of diameter, length of fuse metal, loads on

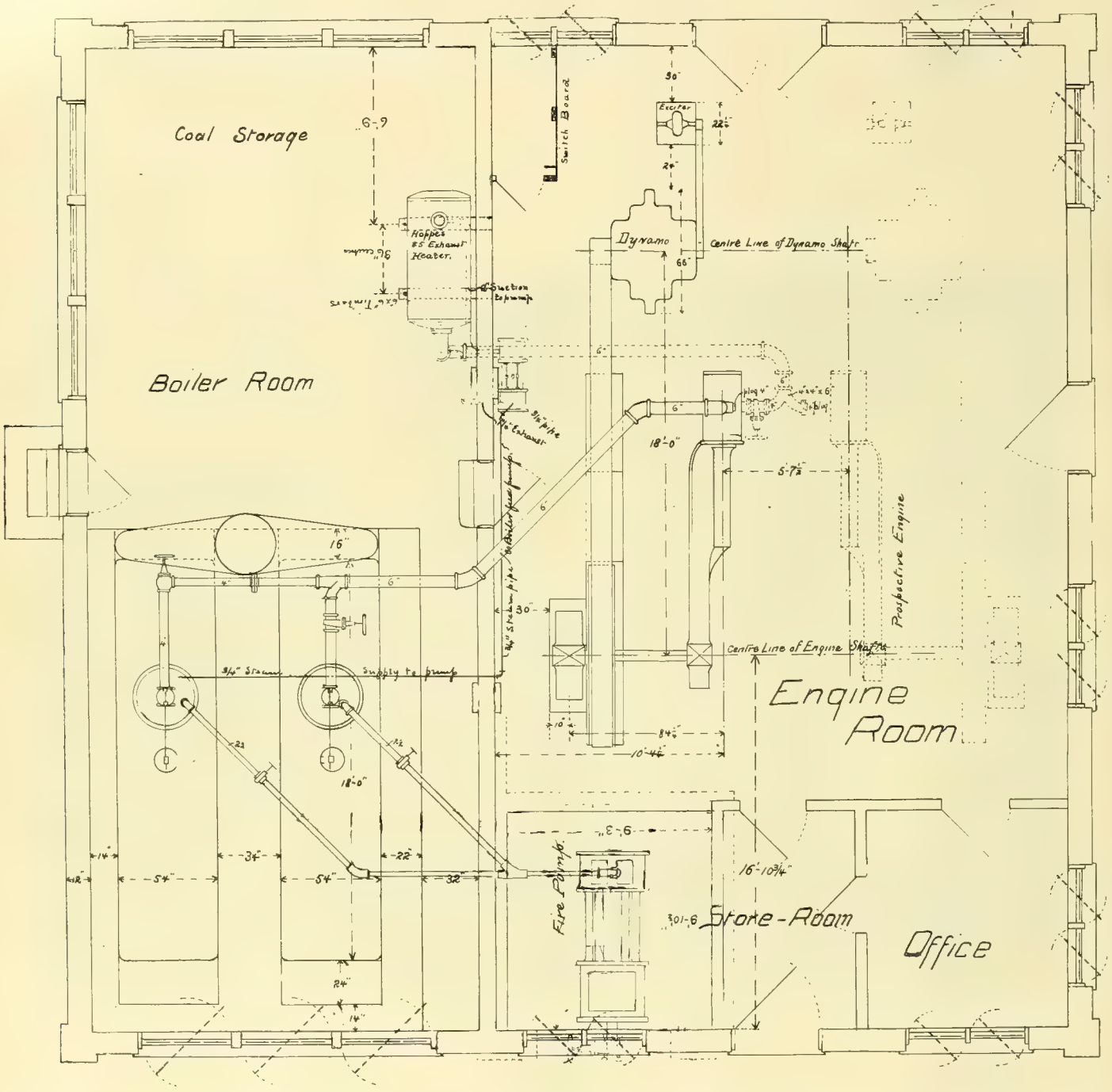


FIG. 2. MUNICIPAL LIGHTING PLAN AT HAWARDEN, IOWA.—GENERAL FLOOR PLANT OF STATION.

1. Read at the twelfth general meeting of the American Institute Electrical Engineers, Niagara Falls, N. Y., June 23, 1895.

the generators at the time tests were made and heating of the leading wires as the tests were being made. By averaging B the law for copper wires on 500 volt short-circuits could be stated to be:

$$C = 460{,}000\ d^2,$$

or, expressed directly in terms of circular mils, the current which will flow in copper wires on 500 volt short-circuit will be

$$C = \frac{C.\ M.}{1.9},$$

where C = current in amperes,
C. M. = circular mils.

TABLE II.—ALUMINUM WIRE.

| Size B. & S. Gauge | C. M. | S. C. Amperes. | B. |
|---|---|---|---|
| 24 | 4 4 | 2 | 500,000 |
| 21 | [illegible] | 2 | 358,000 |
| 20 | 1,621 | 325 | 312,000 |

For aluminum the law for 500 volt short-circuit currents would be:

$$C = 302{,}000\ d^2.$$

$$C = \frac{C.\ M.}{2.6}.$$

There was one very pronounced peculiarity in the action of aluminum during the short-circuits; the metal seemed to burn longer and pieces of metal would come down after the explosion still burning.

TABLE III.—STOCK (LEAD AND TIN) FUSE WIRE.

| Size B. & S. Gauge. | Rating Fuse Wire Amps | C. M. $d^2$. | S. C. Amperes. | B. |
|---|---|---|---|---|
| 24 | 1 | 404 | 50 | 125 000 |
| 21 | 3 | 810 | 115 | 156,000 |
| 19 | 5 | 1,252 | 130 | 106,000 |
| 17 | 7 | 2,048 | 230 | 118,000 |
| 15 | 10 | 3,256 | 290 | 86,000 |

For fuse metal (ordinary commercial lead and tin alloy) the law for 500 volt short-circuit currents would be:

$$C = 118{,}000\ d^2.$$

$$C = \frac{C.\ M.}{9}.$$

The dense heavy suffocating smoke attending the short-circuiting of lead and tin fuse metals was very pronounced and disagreeable.

Copper gave the best result as regards quantity of current per cross-section of metal. This is shown in the formula for copper

$$C = \frac{C.\ M.}{1.9},$$

where compared to the other metals the current per circular mil is a maximum, and that the amount of metal to disintegrate for a given current would be a minimum. In all the tests the behavior of the copper short-circuits were noticeably short and attended with a loud explosive report, with but little comparative flash.

One phenomenon was noticeable when a cold surface, such as glass, was placed in the immediate path of the discharge; a finely deposited surface of light copper would present itself. This was unquestionably a case of condensation of the copper gases. While it may be argued that the law as enunciated by the writer, covering 500 volt short-circuit currents through fuse metals may not be rigorously true, still it certainly is as true relatively, as that of the law enunciated by Preece, covering the relation between minimum fusing currents and diameters of fuse metals.

In the use of the law for practical work where fuses had to be employed for cases beyond the values as determined by test, the values as obtained by extrapolation in every instance fulfilled the requirements, demonstrating the practical correctness of the law.

A few cases are cited wherein a knowledge of the law would be of practical value: Take railway work, elevator work, in fact any case of varying power transmission, where if fuse metals are employed, the size of the fuse metal is governed not so much by the normal safe carrying capacity of the apparatus to be protected, as it is by the expected normal jumps of current the apparatus is designed for, and expected at times to carry. The standard 18 to 20 foot street railway equipments consisting of, say, two No. 3 or No. 14 Westinghouse motors, usually protected by a piece of No. 14 B. & S. gauge copper wire which will normally fuse under a minimum current of approximately 168 amperes—according to Preece's law—whereas under a 500 volt short-circuit, if not prevented by some foreign means, such as feeder magnetic, or generator magnetic circuit breakers, a flow of approximately 2,000 amperes will ensue. Take another illustration: the lead and the tin alloy fuses employed by the General Electric Company for their G. E. 800 equipments and rated to fuse on 100 amperes will on a 500 volt short-circuit allow a flow of 3,600 amperes for approximately .01 of a second, if not prevented by the opening of the power station magnetic circuit breaker. Further, with this latter type of fuse metal the quantity of metal to disintegrate is so much greater, that usually more harm is done owing to the vicious character of the gas as regards conductivity, this usually establishing other grounds.

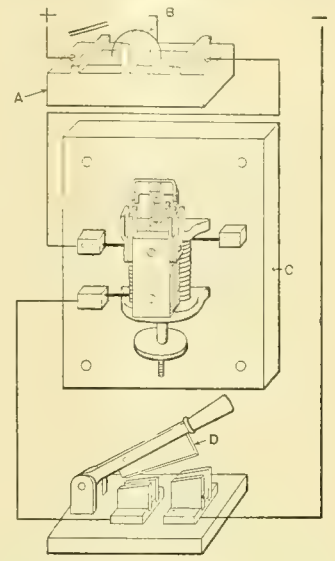


FIG. 1. PROPERTIES OF FUSE METALS WHEN SUBJECTED TO SHORT-CIRCUITS.

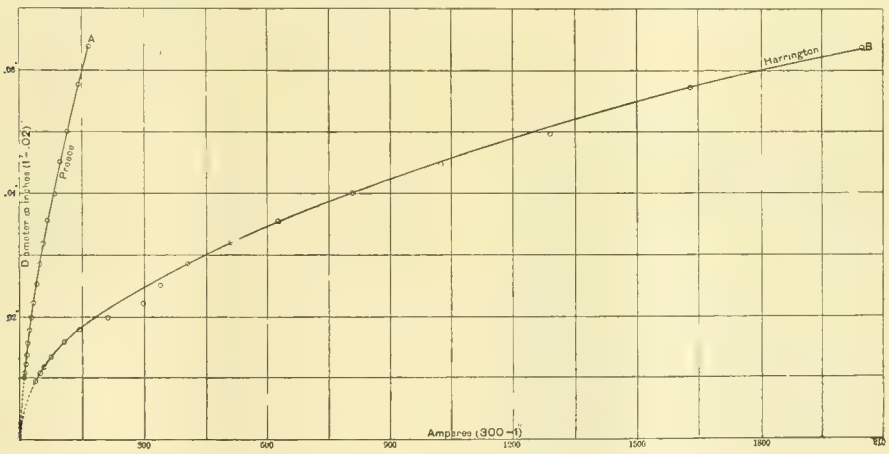


FIG. 2. PROPERTIES OF FUSE METALS WHEN SUBJECTED TO SHORT-CIRCUITS.

At this point it is pertinent to refer to a phenomenon accompanying the "blowing" of a fuse on a 500 volt short-circuit; that is, the destructive arcing following the disintegration of the fuse, maintained, of course, at the expense of the terminals. In the determination of the law $C = B\ d^2$ the after-arcing was eliminated by using a protected terminal fuse block.

TABLE IV.—LAW.

| B. S. Gauge Cop. | Circular Mills | Preece. Regular Amps Rating. | Harrington. Amperes Short Circuit. |
|---|---|---|---|
| 30 | 100 5 | 11 | 39 |
| 29 | 127 7 | 12 | 44 |
| 28 | 159 7 | 14½ | 62 |
| 27 | 201.5 | 17 | 80 |
| 26 | 254 0 | 20 | 118 |
| 25 | 320 4 | 24 | 140 |
| 24 | 404 [illegible] | 29 | 215 |
| 23 | 509 4 | 34 | 298 |
| 22 | 642 7 | 41 | 340 |
| 21 | 810.1 | 48 | 405 |
| 20 | 1,021 [illegible] | 56 | 510 |
| 19 | 1 [illegible] 2 4 | 67 | 625 |
| 18 | 1,624 [illegible] | 82 | 812 |
| 17 | 2,048.2 | 98 | 1 024 |
| 16 | 2,582 [illegible] | 115 | 1,291 |
| 15 | 3.256 7 | 140 | 1,625 |
| 14 | 4 106 8 | 168 | 2,023 |
| 13 | 5,178 4 | 195 | 2,589 |
| 12 | 6 [illegible] 3 | 235 | 3,264 |
| 11 | 8,234 0 | 280 | 4,167 |
| 10 | 10,[illegible]8.0 | 5.0 | 5,190 |
| 9 | 13,094.0 | 395 | 6,547 |
| 8 | 16,509 0 | 470 | 8,000 |
| 7 | 20,[illegible] 0 | 560 | 10,000 |
| 6 | 26,[illegible] [illegible] | 670 | 13,000 |
| 5 | 33,102 0 | 790 | 16,000 |
| 4 | 41,742 0 | 950 | 20 000 |

In a paper entitled "The Destructive Arcing of 500 Volt Fuses" read before the American Street Railway association at Atlanta, Ga., October, 1894, by the writer, this matter is elaborated upon, and in brief shows that the results due to arcing, following the blowing of a fuse, may under short-circuit conditions be far worse than even the results attendant upon the passage of such momentarily great currents.

In Table IV., column 1 gives the size in B. & S. gauge of the copper wires; column 2 gives the circular mils; column 3 gives the minimum fusing current as determined by Preece's law, $C = 10{,}244\ d^{\frac{3}{2}}$, and column 4 gives the fusing currents on 500 volt short-circuits as determined by the law, $C = 470{,}000\ d^2$, enunciated by the writer. Fig. 2 graphically illustrates the pronounced disparity of the two laws, showing the curves of currents for diameter—curve *A* for Preece's law and curve *B* for the law as discovered by the writer. The natural conclusion arising from a knowledge of the above data is that fuse metals are under no circumstances to be considered in the light or nature of a protection.

## Street Railway Company Cannot Use Competitor's Tracks Without Express Authority.

Readers of the WESTERN ELECTRICIAN will remember the street car encounter on Twenty-second street, Chicago, on April 4th last, when the Chicago General Railway company attempted to run a car on the tracks of the Chicago City Railway company. The immediate result of the experiment was the demolition of the venturesome car by Superintendent Bowen and a force of employes of the Chicago City Railway company. The Chicago General Railway company, of which Congressman McGann is the leading spirit, contended that the rails were a part of the public highway, and that it had as much right to operate its car over them as a cab driver had to drive on the track. A suit in chancery was instituted to decide this novel point, and the Chicago City Railway company has been sustained at every point in the exclusive use and operation of its tracks for street railway traffic.

Judge Tuley rendered the decision on August 2d. He held that the complainant has not the right and cannot acquire the right from the City Council to use the tracks of the defendant company without compensation, and the bill of the complainant was dismissed for want of equity.

The opinion is a long one, and the court went fully into the discussion of the question of the right of one company to use the tracks of another company which are laid in a public street.

In 1887 the defendant company obtained an ordinance giving it the right to lay down and operate a street railway in Twenty-second street from State street to the river, and in 1892 the complainant company was given a franchise by the City Council to lay down and operate a street railroad from Grove street to Jefferson street in Twenty-second street. This covered about 300 feet of Twenty-second street which had been granted to the defendant, the City Railway company. The complainant company laid its tracks down and operated its tracks to the Chicago river from the west, to which point the other company was operating its cars from State street.

The ordinance of the General Railway company authorized it to connect its tracks with the Chicago City railway, at or near Grove street, but it gave no right to lay tracks in that part of Twenty-second street occupied by the defendant without the consent of the latter. The ordinance also gave the complainant company the right to operate its cars on tracks not owned by it on such terms as could be agreed to between the companies owning the tracks. In 1894 negotiations were commenced between the two companies with a view to the complainant company running its cars over the tracks of the defendant on the 300 feet of Twenty second street west of Grove street. The city, at the request or the General Railway company, repaired and strengthened the bridge over the river. The tracks of both companies were laid up to the river, and an apparent connection made there between the two roads, but the negotiations as to the joint use of the tracks were broken off before an agreement had been reached.

On April 4th the General company ran one of its cars over the bridge, intending to proceed east for the purpose of testing its right to the use of the Chicago City railway tracks. The car was met by employes of the latter company, who destroyed it. The General Railway company then began suit for an injunction to prevent the other company from interfering with it in its alleged right to use the tracks along with the City railway.

The court discussed the contention of the complainants that they have a right to the free use of the tracks of the other company for the reason that the constitution of the state makes every railway a public highway. On this point Judge Tuley said:

If the true construction of this provision is that railway tracks and rights of ways are public highways in the sense that a road or street is a public highway, which any person can use with any vehicle he thinks proper, then there was no necessity of the complainants obtaining either a legislative or municipal act in order to exercise the right of running cars on or over the defendant's tracks, whether the

same were laid in the streets or over private property. This court cannot conceive how it can be seriously contended that such is a proper construction of the provision of the constitution.

Judge Tuley said that while he was of the opinion that the Legislature could authorize the taking in part and the use of the tracks of one railroad by another and non-competing road by making just compensation, it was doubtful whether the city could authorize this to be done unless its charter gave it the express power. Conceding the ordinance did give it the right to run over the other company's tracks, it could not do so until it had first applied to a law court and had the damages and just compensation to be paid the defendant fixed. A court of chancery could not call a jury to determine the compensation and the latter must be fixed by a court of law. In conclusion, the court said that if the City Council should grant to one street railway company the right to operate its cars over the tracks of other companies it would place the vast properties of the company, amounting to many millions, at the mercy of the whim or cap ice of the City Council.

The court directed that an order be entered dismissing the bill, and the question of an appeal was left unsettled on account of the absence of John S. Miller, attorney for the complainant. Attorney Plumb, representing Mr. Miller's firm, announced that the decision would be appealed from.

## Eastern Organization of Telephone Companies.

As announced recently in the WESTERN ELECTRICIAN, there is a movement on foot in New York city, having for its object the formation of an association of telephone companies to fight the Bell. A dispatch from New York says that telephone manufacturers and makers of telephone apparatus have arranged for an organization to be known as the Eastern Telephone Protective association. A preliminary meeting was held at the Astor House recently at which a committee was appointed to draft by-laws and form a plan for organization. Among the manufacturers present were A. F. Stanley, J. D. Leatherbee, J. H. Scofield, George W. Coy, H. C. Williamson, A. C. Hadburn, S. J. Tunbridge, James R. Strong, H. H. Douglas, Mr. Palmer, of Palmer Brothers, of Mianus, Conn., and Mr. Wettmore, of the Manhattan Electrical Supply company.

Assurances are said to have been received from telephone manufacturers in other cities, that they are ready to support the organization. The immediate and most important object will be to protect the users of telephones manufactured by others than the Bell company, and to wage active war against the old company. The promoters of the new association claim that the troubles of the competitors of the Bell company arise from the latter's intimidation of the telephone customers. Reduction of rates is also contemplated.

It is proposed to construct an electric line to connect Webster and Seabrook, Tex. The route to be selected will be a very picturesque one, as it will follow the shore of Clear Lake nearly the entire distance.

## German Electric Locomotive Crane.

An electrical company in Berlin has brought out a new electric locomotive crane, shown by the accompanying illustrations, reproduced from the *Elektrotechnische Zeitschrift*. This crane embodies several new features, and the object of the designer has been to produce a machine with the least possible complication of parts and levers, so that the man in charge need only possess ordinary common sense to operate the machine successfully.

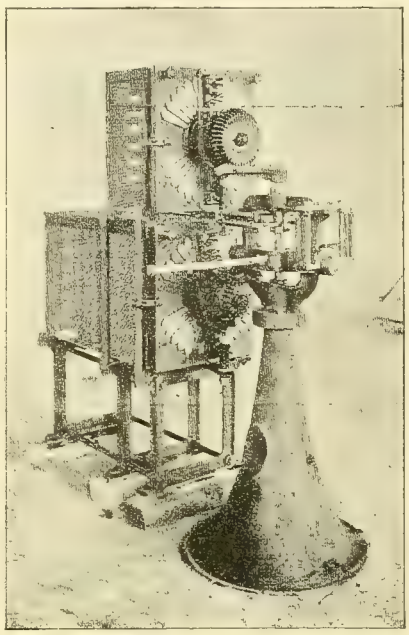

FIG. 2. GERMAN ELECTRIC LOCOMOTIVE CRANE.

Fig. 1 shows the crane complete; the general construction is easily perceived. The equipment has three distinct motors—one of 40 horse power, making 400 revolutions per minute, for operating the drum that winds up the lifting chain; one of 17 horse power of 700 revolutions per minute for operating the turntable, both motions being regulated by one lever, and a third, also of 17 horse power, used for moving the truck on which the crane rests in either direction. The lever for this motor is on the side of the platform. All three motors are iron-clad and well protected; the current is led to them through an ordinary trolley pole.

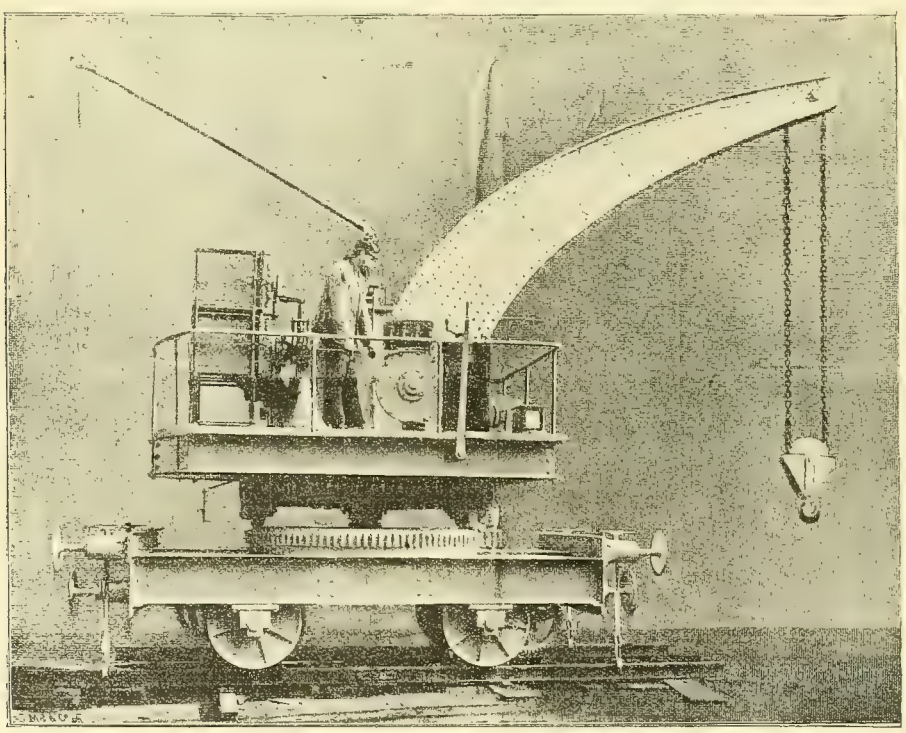

FIG. 1. GERMAN ELECTRIC LOCOMOTIVE CRANE.

Fig. 2 represents the controlling device for this crane, by which only one lever is needed for both vertical and horizontal motion. The lever is attached to the two rheostats, of which one operates the lifting motor and the other the moving motor, by a double cross-head, giving it both a vertical and horizontal motion. When the lever is lifted up it will start the drum motor, winding up the chain and lifting the load with a speed proportional to the inclination of the lever; if the lever is moved downward a reverse motion will take place. If the lever is simultaneously moved to the right or left the turntable will move in the corresponding direction. When the lever is turned back to its position at rest the current is cut off from the motors and instantly an electromagnetic brake is released, stopping the drum and keeping the load suspended in the desired position. If the motorman, by accident, should lose his hold on the lever, a spiral spring attached to the crossheads of the lever will snap it back to its first position; the current is cut off and the brake put in action. By this arrangement all possibility of accident to the machinery is practically avoided, and any ordinary laborer can be entrusted to operate this crane with very little instruction.

The capacity of this electric locomotive crane is six tons, and it will lift this weight with a speed of about one foot per second. The speed of the turntable is about four feet per second on the large gear wheel, and the total weight is 21 tons.

## Indiana Avenue Promises.

The Chicago City Railway company is making every effort to secure the property owners' consent to the introduction of an overhead trolley line in Indiana avenue. The residents on the street are quiet and conservative and most of them profess to be satisfied with the existing horse car service. The contest is an interesting one. Recently a very fine car was put on the line, and it bore this announcement:

This is the kind of cars that will be used on this line when electricity is substituted for horses.

Following this inducement came the following nicely written letter from the company to property owners:

We wish to thank those who have signed frontage consent to change the horse to electric power in Indiana avenue, and to congratulate such signers upon the fact that the frontage already signed is nearly sufficient to warrant a speedy removal of the horse car from that street.

We send this chiefly to correct and deny a report recently circulated by some unknown and untruthful person to the effect that we were paying for frontage. This is not true. We shall not pay for frontage and shall not, directly or indirectly, purchase consent or property; we shall not resort to questionable methods, and the unfairness of such scheme to those having already signed is so manifest that it ought not to be necessary to stamp the story as false and unfair.

As we have ordered cars constructed like car "1895," recently run in Indiana avenue, for the purpose of equipping that street with the best cars known, which shall be lighted with Pintsch gas, we again express the hope that you will sign the petition and hasten the construction and change of that line. It is the general belief that such change will advance values in Indiana avenue, where no advance has occurred for many years; will fill up vacant and unoccupied houses and flats, more numerous than on any other street in Chicago; will dress up and cause repair to many houses now somewhat incongruous; will drive from the street the excessive traffic and teaming and the obnoxious night wagons; will generally improve the comforts of the residents on that street, and will remove therefrom the horse, which is a reminiscence in street car operation and assists only in adding dirt to the street.

Clean, comfortable and beautiful cars are guaranteed with the rapid transit proposed. The experimental, doubtful and impracticable underground system suggested for Indiana avenue is impossible, and will not be considered, and has many objections when applied to that street not existing in the system proposed. A slot in a residence street is more objectionable than the center pole proposed, and unavoidable leaks and disturbances in the underground system are more dangerous and objectionable than the proposed line where the wire becomes dead when a "short-circuit" or "ground" occurs. If the speed of the car has an objection, a like objection can be made to any underground or cable system. Again, the cars of Indiana avenue will not be run in Clark street, but will be trailers of the cable train in Wabash avenue. No other arrangement has been contemplated or will be considered. The Pintsch gas is to be used, because the cars are trailers in Wabash avenue.

Permit us again to bring to your attention the enclosed circulars, hoping that you will sign the enclosed petition and return to us.

The fight is still on.

## Initial Success of the First Electric Locomotives, and Its Significance.

[From the Boston *Evening Transcript*.]

At Baltimore specially designed electric locomotives of great weight will haul the regular trains of the Baltimore & Ohio road. This will be the first serious attempt to displace the steam locomotive in regular steam railroad service.

On its complete success much depends. If it proves economical there is no question but that roads like the Pennsylvania and the New York Central will give the matter of changing their motive power for local, if not for through traffic, serious consideration.

Two of these electric locomotives will be used to haul the Baltimore & Ohio trains through Baltimore's $8,000,000 tunnel, which, by the way, is 7,430 feet long, extending under the business part of the city, and contains strictly speaking, the only underground electric road in the country.

## The Lyons Electric Railway.

The [illegible] railway which was one of the interesting features of the Lyons Exposition was indebted for its motive power to a gas engine of the Buire Lencauchez system, known as the "simplex" engine.

The principle of this engine is much the same as that of all other gas engines. The slow combustion of coal mixed with the steam produces a gas poor in lighting properties, but rich in carbon oxides and hydrogen, and having a heating capacity of about 1,500 calorics. This is its fuel. What distinguishes this from other gasogene systems is the complete absence of a boiler. The steam, which is usually furnished by a separate boiler, is produced here in the generator itself, water being forced by a heavy air pressure into minute drops which fall upon the incandescent products of combustion and are thus converted.

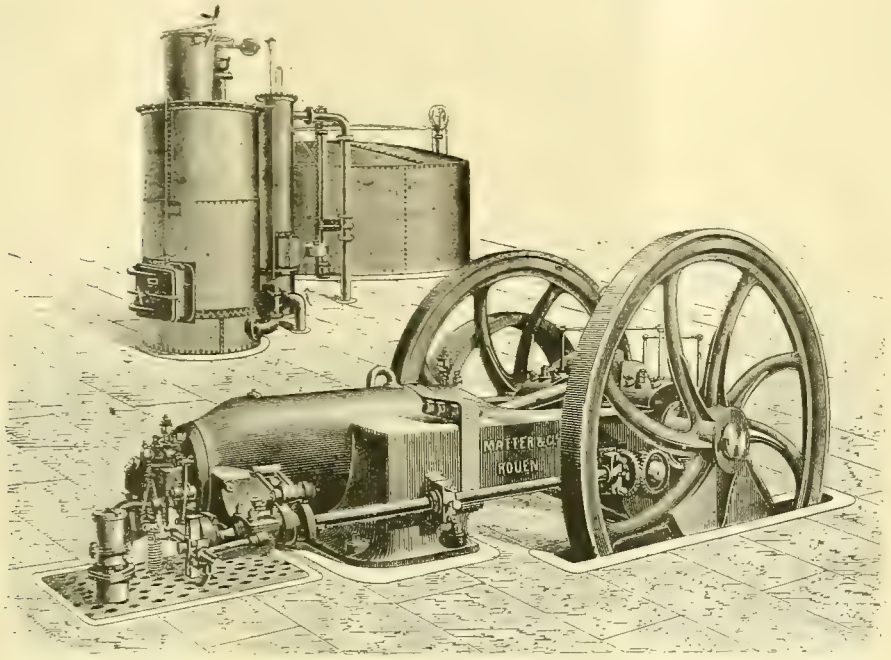


FIG. 1. THE LYONS ELECTRIC RAILWAY.—BUIRE-LENCAUCHEZ GAS ENGINE, GENERATOR AND GASOMETER.

This arrangement is an economical one, and dispenses with a chimney as well as a boiler, and also makes constant attendance and watching almost unnecessary, a condition of affairs which would be impossible with even the smallest boiler. It has, however, the disadvantage of requiring to be frequently cleaned of the accumulation with which its internal structure constantly covers itself.

Fig. 1 shows the complete generator with the motor in the foreground. The former consists of a vertical cylindrical oven, completely closed, at the upper part of which is a hopper where the combustibles are introduced. Above the grate a thin stream of water flows, which is converted into a fine spray by an air blast entering through the closed ash pan. A blower driven by the motor furnishes this draft. The poor gas is led from the upper part of the cylinder to the base of the filter of coke, through which a column of cold water percolates, and is washed. It then flows into the gasometer, whence, by a pipe beneath the floor, it is admitted to the engine.

The engine, which has but a single cylinder, has two flywheels and a transmission pulley. An automatic safety valve, maneuvered by a connection from the upper part of the gasometer, opens to allow the air an outward escape, when the gasometer is full, and the production of gas is thus temporarily reduced to a mimimum.

When during working hours, or at the close of the day's labor, the engine comes to rest, the gas is not extinguished, because of the difficulty of re-lighting. When the engine is brought to a stop the blower ceases to move and a very light consumption of carbon takes place, something like one kilogram per hour, during the rest. As a rule, then, the gas burns through the twenty-four hours of the day, and it is only extinguished when the cleaning of the grate is absolutely necessary.

The gas motor, of which the angular speed is 125 revolutions per minute, drives a six-pole Thury dynamo making 300 revolutions per minute, which has a capacity of 155 kilowatts, but is seldom called on for over 80 kilowatts, at a tension of about 500 volts. Of course, the output is constantly varying, there being five trains on the line at the same moment.

The 12 carriages which furnished the service between the Exposition grounds and the Lafayette bridge were of the closed form without the double deck or "imperial," with 22 inside places, and outside standing room on the platforms for 20 passengers.

Each car has an axle motor, upon which is mounted a cog gear receiving its movement from a wheel solidly fixed on the shaft of the electric motor. The train of gearing, which reduces the motion of the electric motor to a proper speed, is run in a box filled with oil.

The 500 volt current is used for lighting the cars, five 100 volt lamps being placed in series—one in the front, one in the rear, and three in the interior of each vehicle.

Sliding contacts on the center rail transmit the current to the car motor; there is no overhead trolley. At either end of the car a commutator with 12 contacts regulates the movements of the train, through the rheostat, which is located on the roof. There is also a reversing lever with a switch at each extremity of the car and an emergency brake switch in addition.

No difficulty is experienced in making changes of direction, switching, etc. Stopping and starting at road crossings are readily accomplished, and a speed of 35 kilometers per hour has been attained experimentally, although the usual speed is about 25 kilometers.

FIG. 2. THE LYONS ELECTRIC RAILWAY.—CLARET-VUILLEUMIER TRAINS LEAVING THE STATION.

Fig. 2 gives an idea of how electric cars without a trolley look, this being an illustration of the Lyons road at the station.

The inventors, Messrs. Claret and Vuilleumier, according to *L'Eclairage Electrique*, from which the illustrations and facts are gleaned, contend strongly for the superiority of their system over the overhead systems for thickly populated districts, while conceding the advantages of the aerial method for sparsely inhabited precincts, country roads, and the like. The difference in cost of the two systems, they assume, would be comparatively trifling, when the superior advantages of their system are considered. The road was operated continuously during the Exposition, and carried 730,862 passengers, making a total of 115,000 car-kilometers run.

The authorities of Paris are so well pleased with the system that a franchise has been granted Messrs. Claret and Vuilleumier for an electrical line from the Place of the Republic to Romainville, from the Boulevard St. Martin in a northeasterly direction to the city limits. The work will be commenced at once.

## Electricity and Plant Life.

The *New York Herald* announces that the employment of electricity to hasten vegetable growth is "technically known as electroculture," and it gives this information:

At the Ithaca (N. Y.) experiment station Prof. Bailey, by the aid of electric lights burned all night in greenhouses, makes plant life work "overtime"—that is, he forces plants to do both day work and night work without a moment of "sleep." Sunlight, as well as atmosphere and water, is necessary for a plant's development. The electric light resembles sunlight in its composition more than does any other artificial light. It is the common theory that plants grow mostly at night, making use of the air, water, sunlight, and other materials which they have received during the day, when the sun is shining. It is generally believed, therefore, that they need rest, just as animals need rest, for the building up of the tissues worn out during the day. Prof. Bailey, however, does not believe that plants need rest in the same sense that animals do. Plants have simply acquired the habit of gathering nourishment and using it at different times, because nature has divided the day into light and darkness, and because it is better to "make hay while the sun shines," and to use it at night when there is nothing else to do. There appears to Prof. Bailey to be no reason why plants cannot grow in full light. In the arctic regions, where the year is divided into one long day and one long night, plants grow continuously, as conditions require. Now, if electric light enables plants to acquire stimulation during the night and does not interfere with growth, it will cause them to grow to a greater size.

Artificial lights are found to produce much the same effect upon plants as does sunlight, only in a smaller degree. If a ray from an electric arc light be thrown through a prism it will separate into various colors, as will a ray of sunlight. The arc light contains more violet rays than sunlight, but has less orange rays, which latter are very valuable to plants. By using an amber globe over the arc light, therefore, its rays become more like sunlight. Prof. Bailey has experimented both with a naked arc light and with one covered by a globe. He hung the uncovered arc light, of 2,000 candle power, inside his greenhouse, burning it all night. He found that the plants matured earlier than others in a greenhouse lighted only by the sun. The nearer the plants were to the light the faster was their growth.

While Prof. Bailey is continuing his experiments with the arc light similar investigations are being made with the incandescent lamp at the West Virginia experiment station under Prof. F. W. Rane.

Prof. Rane prefers the incandescent lamp, because it is cheaper, consumes less time, and is not so bulky. Prof. Rane is meeting with much the same results as noticed by Prof. Bailey. He finds that the stronger he makes the candle power the more marked are the increases in growth.

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THE prospect of the operation of electric locomotives on existing trunk-line railroads for passenger service, replacing steam locomotives, is sufficiently promising to attract the attention of some of the largest business corporations in the country. It is now reported that the Westinghouse Electric & Manufacturing company and the Baldwin Locomotive Works, anticipating a demand for the new type of locomotives from the steam railroad companies that are now investigating the question, have entered into an agreement by which they will pool their issues, as it were, to exploit and build up this new industry. Such a combination would be a very strong one, and as there is a demand, even at the present day, for electric locomotives for suburban line, elevated and switching service, there should be a field for its efforts.

WHEN the National Electric Light association held its convention at Montreal a few years ago the hospitality of the Canadians quite overcame the visitors, and many of those who had the pleasure of attending that meeting will not miss the opportunity to participate in the gathering of street railway men which will take place there in October. It looks as if our Canadian brethren were bent upon surpassing all former efforts, and were determined to establish a new record this fall. There is no city on this continent which recalls brighter recollections in the minds of electrical men than Montreal, and we predict for all who attend this year's convention of the American Street Railway association a most enjoyable visit to one of the most beautiful and hospitable cities on American soil.

FASHIONABLE Long Branch is in a flutter because of the advent of the trolley, and many "influential residents" have threatened to withdraw their patronage and presence; but just where they will go is a problem, as the trolley is to be found everywhere these days. The only objection to the improvement is that it will open up the exclusive resort to the outside world. One New York paper gives the names of several prominent business men of Gotham who have "openly declared that if the trolley should come they would leave Long Branch if they had to give their houses away or shut them up." Another paragraph furnished by the same correspondent contains the very interesting announcement: "'I hear you are going to have a trolley here,' said Mrs. George M. Pullman, when she arrived this season. 'If so, you will not see me next year.'" All of which sounds very silly to the average American citizen.

AFTER all the fuss and talk about investigating trolley accidents in Chicago, it seems that the examination of the grand jury was confined to one case brought before it by the surviving relatives and friends of a victim of an accident on the South Chicago & Calumet road. It is not clear that the case was one in which the railway company could be held for damages, but it is claimed that evidence was suppressed, and in order to get even with the company the attorney for the relatives of the unfortunate woman who was killed caused the present investigation to be set on foot. An officer of the company when summoned before the grand jury is reported by a Chicago daily newspaper to have testified that one of the grand jurors was a lawyer who was interested in collecting claims against the road for damages. He declared that in his opinion the whole investigation was merely a scheme to sandbag the street railway companies. It might to be well for a special grand jury to investigate this matter. The statement should not be permitted to pass unchallenged. The claim agents for the Chicago street railway companies tell some very interesting stories of methods employed by shady lawyers to collect damages from these corporations.

THE president of the town of Cicero, Ill., has some very pronounced views on the subject of the value of public franchises, and he insists upon corporations securing such privileges making ample compensation. He says in a recent communication upon this subject to the town board that the time has come when no railroad company should be given a franchise which does not provide some revenue for the town. That these franchises are valuable is evidenced by the earnestness with which the promoters press their claims, and, if valuable, they should pay to the town a certain amount for each mile of street asked for, and either an annual license on each car or a certain per cent. of the gross earnings; such license or per cent. to begin a certain number of years after the road shall have been built and when returns on the actual investment shall warrant it. There is no doubt that public opinion strongly favors some such policy as this, and street railway companies must recognize this fact. Cities, towns and villages can afford to be generous in their treatment of street railway and similar corporations, for while these enterprises are generally very desirable investments, they certainly confer great benefits upon the public, and while the stockholders secure good returns the community enjoys corresponding benefits.

WHAT we feared has come to pass. We predicted a month ago that the similarity in name and appearance of the *Electrical Journal* (San Francisco) and the *Electrical Journal* (Chicago) would prove "a constant source of annoyance." In all kindness we pointed out to our young contemporaries that a change of name on the part of one of them was desirable, or at least that they should make a geographical distinction in their titles. This disinterested and benevolent suggestion did not meet the grateful appreciation from Supt. Barrett's philanthropic publication that it seemed to us to deserve. The *Electrical Journal* of Chicago manifested an acrimonious determination to retain the name selected by the new San Francisco review, not, perhaps, that it might filch unearned glory, but from some unknown purpose of its own.

This course is ill-advised and will result in confusion. One instance of this is already at hand, and it justifies our apprehension. *Electricity* of London reviews the first issue of the *Electrical Journal* (San Francisco) and says: "The editors are Dr. Perrine and Mr. G. P. Low; the aims are 'honesty, breadth and helpfulness.' Naturally, the National School of Electricity is regarded favorably." There you are; the organ of the National School of Electricity is mixed up with the new electrical review of the Pacific Slope. Imagine the feelings of Mr. Low and Dr. Perrine! Their aims are said to be "honesty, breadth and helpfulness," and in the next breath it is stated that "Naturally, the National School of Electricity is regarded favorably." What could be more confusing?

In the interest of accuracy, truth and justice, we again call upon the *Electrical Journals* to distinguish themselves, the one from the other.

PRELIMINARY steps have been taken by eastern manufacturers of telephone apparatus to form an association with the avowed purpose of fighting the American Bell Telephone company. The plan of organization, as outlined in the dispatches from New York, is somewhat similar to that of the association formed at Chicago recently, but if the reports be true there are many points of difference between the two associations. Just what the policy of the eastern association will be has not yet been announced, and it is feared by some that the two organizations will not work harmoniously, although their avowed object is the protection of anti-Bell companies against the attacks of the old monopoly. It is to be regretted that there is any division in the ranks of the telephone manufacturers, for they will find plenty of work on hand fighting the Bell company without wasting valuable time and taxing their resources in fighting among themselves. It seems as if the reputable business organizations of the country engaged in the manufacture and installation of telephones and telephone supplies should be able to unite in one organization for the protection of the members, large and small, and thus get rid of sectional strife. To engage in petty bickerings at this time means certain failure.

IT would appear that the local telephone companies operating under Bell patents throughout the Northwest are alive to the importance of the opposition that has developed against the old corporation and they are resorting to every expedient to check the advance of new concerns. In a Minnesota town last week a local company asked for a franchise to establish a competing exchange and the representatives of the Bell company attempted to bulldoze the council by threats of legal proceedings. The financial standing of the promoters of the new company was attacked by the Bell agents, upon the representation of correspondents, but when these statements were challenged the Bell company refused to make specific charges or divulge the source of its information. Thereupon the council promptly showed its disapproval of such tactics by immediately granting the new company a very favorable franchise. This is encouraging news to the promoters of similar enterprises who have been obliged to meet all sorts of charges circulated by irresponsible Bell agents. Of course that corporation will not assume responsibility for these utterances, but it has no hesitation about taking advantage of them when they have any effect upon timid officials. Such a policy is held in contempt by right minded men.

IT IS an interesting study, and one that cannot fail to make a lasting impression upon the close observer of events of the times, to note the gradual progress that is being made by every department of industrial activity in regaining the position occupied before the commercial depression visited the country during the last two years. There is more confidence manifested now than there was three months ago, and merchants are looking forward hopefully to a prosperous fall trade. The volume of business has already showed material increase, that during the last month comparing favorably with the corresponding period a year ago. Then, too, there are evidences on all sides of preparations for even greater advances. Manufacturers seem to be of one mind in predicting great industrial activity during the next six months. It is reasonable to assume under the circumstances that there are good grounds for this confidence. Those who have looked over the entire field are really enthusiastic over the prospect. One New England manufacturer of electrical supplies who was in Chicago last week predicted an unprecedented boom in the electrical business within the next twelve months. He had made a careful study of the situation, and he announced that his personal observation of affairs throughout the western and central states indicated an enormous business this fall and winter. He said, too, that in other sections of the country there was noticeable improvement, but nowhere was it so apparent as in the western and central states. Others, equally well informed, agree perfectly with this prediction. There is an upward tendency in prices, too, that looks encouraging for those who have been struggling along during the last two years with the hope of maintaining their standing until there would be a return to conditions that would afford some compensation for the effort. At the present time the outlook is certainly brighter than it has been in many months, and there is reason to rejoice in the return to good times.

## Electrical Interference.[1]

By Arthur Vaughan Abbott, C. E.

The extensive commercial use of electricity has given rise to some curious questions, both legal and scientific, regarding the mutual rights of the proprietors of electric circuits, and their relations to the public.

The subtile nature of electricity and its peculiar ability to produce the effect of action at a distance, apparently without the intervention of any intervening medium, increases the difficulty of dealing with such problems and leads occasionally to seemingly ridiculous conclusions. Thus, not long since, an electric railway was plaintiff in an action to recover damages from someone who had been discovered stealing current from the trolley wire, but was non-suited, the presiding judge giving his opinion that as electricity was not a substance it could not be stolen. However correct such premises and logic may be, it is certain that few central station men would approve either of the conclusion or the practice it would apparently sanction.

It is considered good equity, though not necessarily good law, that neither individuals nor corporations shall take any action on their own property, or upon the public highways, that shall militate against, or interfere with, the enjoyment of similar rights by others. Electrical circuits not infrequently exercise a very serious mutual interference with each other, and occasionally become sources of danger to both life and property, and it is therefore pertinent to inquire into the conditions giving rise to such interference and the possible remedies. For convenience in treatment the subject may be divided into four general heads: First, leakage; second, inductive disturbance,—(a) electromagnetic induction, (b) electrostatic induction; third, common path interference; fourth, electrolytic action.

### LEAKAGE.

Every electrical plant consists of three parts. Some form of generator (dynamo or battery), in which electrical energy is produced, a set of receiving mechanisms, or translating devices, whereby the energy evolved by the generators may be usefully employed, and a conducting circuit uniting the generators and receivers and forming the road over which the electricity should travel. As there is no substance that is a perfect conductor, offering no opposition to the passage of the current, there is always a constant tendency for some of the electricity to leave its proper path, and return to the generator by other and foreign routes. As there is no substance that is a perfect insulator, absolutely preventing all leakage, there will always be a certain, and usually an appreciable escape of electricity from even the best designed and constructed circuits. The difference in admittance between conductors and insulators is, however, usually so great that by proper design and appropriate construction all electric circuits may, at least in a commercial sense, be perfectly protected and all damage from such leakage obviated. Chiefly from the rapid growth of electrical development, the tendency has been to install carelessly, and superintend and maintain imperfectly, hence, it is hardly an exaggeration to state that a notable proportion of the electrical plants now in operation are, or are likely to become, sources of danger to adjacent circuits and to life and property, by reason of leakage. The remedy is obvious; skill in design, care and fidelity in execution, and the adoption of the highest standard of electrical maintenance will eliminate all possible danger from this source. Electricity is the most powerful, and withal the most dangerous form of energy. Like fire it is the best of servants but the worst of masters. Deservedly popular, it only rests with electrical engineers to secure its universal introduction, by insisting upon such quality of work as will inspire universal confidence.

### INDUCTIVE DISTURBANCE.

The presence of electricity along a conducting circuit gives rise to very strange effects on adjacent bodies that, at present, can only be partially explained. These effects are made manifest by a disturbance of the electrical equilibrium existing in bodies adjacent, the intensity of which is inversely proportional to the remoteness of the perturbing circuit, directly proportional to the intensity of the electrical variations in the perturbing circuit, and but little affected by the character of the intervening medium. The process giving rise to such disturbance has been termed "induction," and manifests itself in two different ways, respectively termed "electromagnetic" and "electrostatic induction."

*Electromagnetic Induction.*—To Faraday is due the discovery that every electrical circuit in some mysterious way excites in the space surrounding it that peculiar state termed a magnetic field, varying intensity of which instantly responds to every electrical change, and the converse proposition that all changes in the magnetic field surrounding a closed conductor produce an accompanying electrical current in it.

Consider two circuits in reasonably close proximity to each other, such as would occur with two wires on a pole line on the same side of the street, or cable conductors in the same trench. Assume one circuit to be carrying an alternating current varying from a positive to a negative maximum many times a second. With every wave we have a similar magnetic whirl, which travels outward from the wire as a center, looping its lines of force with all the other neighboring circuits, and exciting in them electromotive forces that may severely interfere with their normal operation. The gravity of the disturbance thus produced will depend upon the exciting power of the perturbing circuit, the distance between the circuits and the sensitiveness of the translating devices placed on the adjacent conductor.

If it be advanced that but little difficulty has so far been experienced from this cause, the reply is that electrical development has but just commenced and that inductive interference will rapidly multiply with the multiplication of disturbing plants. Further, in this country but little use has been made of alternating current distributions of magnitude, the most prolific source of inductive interference, but in Europe, where such installations are common, the difficulty has already been severely felt.

Inevitably, circuits containing the most sensitive receivers are the earliest and the keenest sufferers, and telephone and telegraph lines have, in some instances, been paralyzed from such interference.

The simplest and surest relief is to separate the interfering circuits by such a distance as will render the inductive effect inappreciable. Unfortunately, induction is most powerfully manifest in crowded situations where there is the least choice of circuit location and the greatest multiplicity of conductors.

In electromagnetic induction an actual current is set up in the neighboring conductors by the perturbing circuit. Plainly, if the disturbing circuit be so located with reference to other circuits as to enable the inducted waves to neutralize each other, no trouble would be experienced. This is usually accomplished by frequently transposing the relative geometrical positions of the conductors, either by twisting them together as in a cable, or by placing them successively on different pins in pole line work. Either the perturbed, the perturbing circuit, or both, may be transposed with reference to each other, although the first expedient is the one usually adopted. The same results are attained by the use of concentric conductors for either, or both, of the circuits, for by this form of construction, theoretically the most perfect neutralization is secured.

As the disturbance due to electromagnetic induction is owing to an actual flow of current, it is occasionally practicable to eliminate the difficulty by opening the disturbed circuit, either by a condenser, or by the introduction of an impedance of such dimensions as will choke out the objectionable impulses, while permitting the desirable ones to pass. This method evidently requires a special design for each particular case, and can only be indicated on general principles. When properly arranged, this plan is exceedingly successful, to such an extent that the practice of telegraphing and telephoning over the same wire, by the use of properly arranged condensers and impedance coils, is successfully carried out.

*Electrostatic Induction.*—It occasionally happens, particularly in cases where a grounded circuit is adjacent to a metallic one, that cases of interference arise which cannot be explained upon any electromagnetic theory, and which are not obviated by opening the disturbed circuit either with a condenser or by an actual break in the same. These disturbances are now usually referred to as electrostatic induction, in which the perturbed and perturbing circuits play the part of the two plates of a condenser, with the air or the earth forming the dielectric. Interference of this kind is relatively quite rare, and usually of so small an amount, at least, with the transmission circuits now in operation, as to be perceptible only with the most delicate receiving mechanisms, such as are found upon telephonic circuits. It is hardly probable that this form of interference will play an important part in any but telephonic installations, though here it is frequently the cause of considerable difficulty. This form of induction is the most difficult to cure, as neither impedance coils or condensers have a marked effect as a remedy. The method of transposition also is comparatively inoperative, the only radical cure, apparently, being the removal of the interfering circuits to a considerable distance from each other. As this form of interference is not likely to be very widespread, and as it probably will not affect transmission plants to any great extent, it may be dismissed as of interest only to the telephonic fraternity.

Transmission plants, particularly those involving the use of large quantities of alternating current, are sure to multiply, in evidence of which there is the Niagara power plant. Already there is sufficient knowledge, if skillfully applied, to insure non-interfering circuit designs—the only way to secure a harmonic and capable transaction of electrical business.

### COMMON PATH RETURNS.

When a single conductor is used in common on a portion of two or more circuits, more or less interference is inevitable. Many cases may occcur where no objectionable results follow, as for instance, in a common trolley wire jointly used by two electrical railways. In such instance, the common use of the single conductor is a matter of agreement between the contracting parties, each of which endures, for the sake of other considerations, any resulting inconvenience, and no controversy as to mutual rights results. A single exception appears in the case of earth returns. In the early telegraphic days a complete metallic circuit was employed, but it was soon discovered that valuable economy in line construction could be effected by the use of the earth as half of the conducting circuit, without any injury to the service.

The early telephone men graduated from the telegraph school and consequently adhered to the same practicee Telephonic and telegraphic currents were so small that littl. or no interference resulted, excepting occasional troubles due to earth currents, for which nothing but a solar cyclone could be held responsible. With the advent of transmission plants incalculably larger amounts of electrical energy were dumped into the earth, that, seeking a return by the path of least resistance, buzzed and hummed through the unfortunate telephones and sounders in a way to drive the perplexed electricians distracted, to say nothing of the general public.

Early lighting plants attempted a grounded return, with such inevitably uncertain service and loss of efficiency as to speedily drive them to a complete metallic circuit. At present electric railways are the only transmission plants of magnitude that have a ground return, unless the earthing of the neutral in multiple wire plants be included in this term. Against this use of the earth the telephone and telegraph made the bitterest of fights in early electric railway days, and in every instance were defeated, and justly, the courts holding that no single enterprise could appropriate the globe as a return conductor to the exclusion of all others. The remedy for interference of this description is easy. Give everyone a complete metallic circuit and all difficulty will immediately cease. Of course, the old bugbear of prohibitive construction expense is immediately advanced, but this, like the "Specter of the Threshold," will disappear when boldly confronted. There are few electric railways that by the improved conductance of a complete metallic circuit would not annually save in coal more than the interest of the extra capital required in line construction. Quieter lines, freedom from errors and avoidance of repetitions, would amply repay the telephonic subscriber for the slight increased cost of metallic circuits.

Transcontinental telegraph lines may perhaps continue on grounded return, as they would be placed under the heaviest expense, and injured least by the absence of the metallic circuit. Each and every other electrical enterprise should be provided with its own individual and exclusive path as the surest, safest and, in the end, most remunerative method of construction.

### ELECTROLYTIC ACTION.

The last division of the subject is that which at present is causing the greatest annoyance and is likely to be followed by the gravest and most severe consequences. When the earth is employed to form a portion of an electric circuit, the current on entering the ground wanders off in all directions, seeking paths of the least resistance. Water courses, damp strata and the like are immediately charged, and, if there exists lines of water or gas pipe, or other metallic structures of lower specific resistance than the earth, the current immediately seizes upon them as convenient and easy homeward routes. Were this the end of the process but little objection would be raised, for it is doubtful if any underground structure could be so heavily charged as to become injurious merely by the presence of electrical energy, and the simple passage of the current through portions of city pipe lines could do no harm. Another set of objections, however, obtains, for under the circumstances described all the elements of an electrolytic cell exist, the metallic portions of the originating circuit forming the positive pole, the soil, holding moisture and organic acids, the electrolyte, and the various underground metallic structures the negative poles. A study of the operations taking place in any electrolytic cell shows that the action of the current is such as to remove particles of metal from the negative pole and to transfer them into the electrolyte and ultimately carry them to the positive pole. Such a process as this inevitably results in the more or less speedy destruction of the negative element, and thus all transmission plants operated with a grounded return reproduce on a large scale the destructive conditions of the electrolytic cell, wherein the metallic structures in the ground play the part of positive and negative electrodes.

Electric railways, as the principal transmission plant adopting the grounded return, are the ones chiefly involved in this form of interference. So long as the various metallic structures in the street, owned by others than the electric railway company, are electro-negative to the railway circuit, the only effect to be produced will be the gradual deposition of metal from the railway circuit upon these structures, which probably would be the occasion of no injury whatsoever. The rails, rail bonds and return wires of the railway will inevitably suffer severely from corrosive influences, as has already been noted in many cases, but no actual interference can be alleged, and the railway company must protect itself from destructive influences of this kind as best it may.

If any portion of other underground structures become electro-positive to the railway circuit, the current at this point leaves the pipe line or other metallic structure, and a lively corrosive action is immediately set up. In the case of water pipes, gas pipes, cable sheaths or similar metallic structures, the result is severe and destructive, pitting the surface to such an extent that the pipe lines soon become leaky, the cable sheaths destroyed and the cables ruined. This effect has already attracted widespread attention by the magnitude of the injury which has been done in larger cities, such as Boston, Brooklyn, Rochester, Cincinnati, Omaha, San Francisco, etc. In every instance a careful electrical survey located and indicated the injury to be due to current introduced into the soil by the street railway that left the underground metallic structures at the various points where the injury was noted. The water pipe, gas pipe and other underground structures in our cities are too important and too necessary to be subjected to any possible destroying influences of this kind, and the effect of electrolytic action has been immediately to restrict the issuance of electrical railway franchises, and has operated as a severe check against the growth and extension of this branch of electrical industry. Two methods of remedy are proposed. The first and surest is the adoption of a double trolley system, by means of which the railway circuit is removed from the earth entirely, and exclusively placed upon its own and appropriate overhead lines. Where this means is adopted there can be no question either of corrosive action or any other interference from the railway circuit. In answer to this the statement will immediately be advanced, that it is impracticable to operate an electric railway upon a double trolley system. This, however, is a fallacious argument. The double trolley was in operation previous to the adoption of the single trolley and there is, therefore, no reason why it should not again come into practical operation.

For the single trolley two arguments may be advanced. The first and most important is that of decreased cost of construction secured by the use of the earth as a return circuit. So long as electrical railways were in their infancy and the roads were small and used but a slight amount of electrical energy, the ground offered a convenient and appropriate return path. At present with roads of magnitude it is well understood that the ground cannot be relied upon as any adequate return and that from reasons of fuel economy only an adequate metallic return circuit in the shape of ground feeds or their equivalent must be secured. It thus appears that the rails and the ground, under any circumstances, can only be utilized as a small fraction or portion of the return circuit. The argument of increased cost, therefore, can only be applied to small enterprises of this description. In such cases the amount of electricity dumped into the soil is probably not sufficient to do any great amount of damage, and with appropriate rail bonds, the probable interference with other underground structures can be largely avoided. The other advantage claimed for the single trolley system is the greater simplicity and cheapness of overhead construction and greater ease of maintaining the same. This argument is of much greater importance than that of the decreased expense of the conductor circuit. The construction and operation of the double trolley road is

1 Read before the Northwestern Electrical association, Chicago, July 17, 1895

decidely more complicated than that of the single trolley. The present success of the electric railway is due largely to the constant and perserving expenditure of the best mechanical skill on the invention and reduction to practice of overhead appliances.

With the advent of the single trolley, mechanical and electrical engineers were relieved from the necessity of improving the old and crude forms of double trolley systems and bringing them to a state of commercial perfection.

Now that electrolytic action rises to a point of supreme importance and that railway companies are either likely to be deprived from extending their lines or laid under the penalty of the payment of heavy damages for injury to underground metallic structures, there is no doubt but that sufficient mechanical inventive skill will be quickly found to place the double trolley upon a perfectly successful and commercial basis.

Disastrous corrosive action occurs at points where the underground structures are electro-positive, the current at these locations leaving the pipe line for the earth. Mr. Farnham, electrician of the New England Telephone & Telegraph company of Boston, whose attention was early drawn to this matter, proposed as a remedy, the careful location of the electro-positive points, by means of a voltmeter survey, and then the attachment to the water pipes, cable and other metallic structures of return conductors of such dimensions as should be fully capable of removing all current which tended to leave the metallic structures at the electro-positive point, thus transferring the action to the supplementary conductor that, if necessary, can be easily replaced. It is probably impossible to expect an immediate change to the double trolley, or the adoption of any conduit system which would necessitate the use of two conductors. Thus, for some time to come, the various underground structures in the city streets will be menaced from the presence of street railway currents, and as a protective measure a supplementary conductor attached at the electro-positive points may be introduced as a palliative, if not a complete remedy. Inasmuch as street railway loading varies from time to time with the changes in the traffic on the system, it is necessary to keep a constant supervision over underground metallic structures in order to see that they are constantly protected and that changes in the loading do not introduce additional points of danger.

Electrical interference is, therefore, no longer an inscrutable mystery, though doubtless the future will develop methods of correction far superior to those now in our possession. No interference problems are now likely to occur for which science, combined with an honorable recognition of the rights of others, does not suggest a remedy. In the past two decades, electricity has permeated almost every industry, and the electrical engineer is now wellnigh indispensable to the design of all enterprises of magnitude. It only remains for the profession to establish such an *esprit du corps* as will always demand from each member an exhibition of the highest skill, fidelity and justice in the solution of each problem, to place it in the foremost rank of scientific occupations.

### Discussion.

The Chairman: I would like to ask the gentleman one question bearing directly on the economy of alternating currents. It was not quite clear to me in the paper what you defined as electromagnetic interference and methods of overcoming it.

Mr. Abbott: Electromagnetic interference would be restricted to all those causes of interference where the trouble could be cured by opening the circuit. When I use the words "opening the circuit," I use them in the ordinary continuous current sense. A circuit which is opened by a condensing has no admittance for a continuous current, but will carry an alternating current. The introduction of an impedance coil will open a circuit to an appropriate alternating current, and yet keep it closed for continuous current. In cases where a circuit is carrying a continuous current, and where there is interference by means of an alternating circuit, the introduction of an impedance coil will cure the difficulty by choking out the induced waste of the alternating current and still allow the continuous current to pass unobstructed. In electrostatic interference there is no effect produced by opening the circuit. In cases of electrostatic induction there is as much trouble with the circuit open as when it is closed. It is undoubtedly true that at the bottom of all these phenomena, both in electrostatic and electromagnetic interference, the difficulty rests upon the same foundation, that is to say, on the probable movement of a certain quantity of electricity. But in electromagnetic troubles there is an actual apparent flow of current to and fro; in the case of electrostatic interference this is not the case, and consequently opening the circuit with condensers or repeating coils will have no effect. The interference will remain just as marked as ever. This form of trouble, as noted in my paper, is very small and not likely to interfere with transmission plants at all. But electromagnetic difficulties have already affected transmission plants to a considerable extent. There have been cases of continuous current lighting in Germany in which the establishment of a neighboring alternating current actually put the lamps out; that is to say, interfered to such an extent that the lighting could not be carried on. By the introduction of appropriate impedance coils the trouble was practically cured. The method of transposition accomplishes the same result, but cannot always be employed.

W. D. Ball: You speak of opening the circuit, but I do not quite understand the use of the word.

Mr. Abbott: The term "opening the circuit" must be understood in reference to the current under consideration. A circuit having an impedance coil will be open to an alternating current, but not to a continuous current. Conversely, a circuit with a condenser would be open to continuous current and not open to an alternating one.

Mr. Ball: You take a transformer, for instance, an electromagnetic device, put a condenser in circuit to it, and that is what you would call opening the circuit with the condenser. That would be opening it to continuous current absolutely, but not to alternating. An impedance coil will check out the alternating current, but will allow the continuous current to pass continuously. It means the designing of the apparatus to fit the case.

Geo. Cutter: I have been very much interested in Mr. Abbott's paper, largely to note the different views we take on matters of this sort, as modified by our interests. Now, Mr. Abbott is a telephone man, and it is amusing to those who have spent most of their time perhaps for ten or fifteen years in the heavy engineering problems, to see how a telephone man tackles electrical problems in order to keep the telephones free from trouble with currents in the ground. They do not want to put up another metallic circuit, which would give good service, but which costs money. They would like to have us put up two trolley wires with all the complications as supports and crosses and of leakage, which railroad engineers very well understand. I am confident Mr. Abbott understands them also. We know very well that the railroad companies are not going to accommodate the telephone people in that way. Of course, I am sorry for them, because I would like the telephone company to be left everything under the earth, as they think they own everything above the earth.

But to come to the scientific points in Mr. Abbott's paper. They are of great importance to all central station men operating alternating currents chiefly. It seems to me we must not forget the fact that every time we induce a current in a telephone circuit, or any other conductor, we are doing it at the cost of our coal pile. Now, the question is, how much of our current are we losing by the inductions and leakages and different forms of interference that we have on the circuits outside. It is an important thing, but it is a very difficult question to answer. We can readily understand, if we have an alternating current wire hanging parallel to an iron pipe, or an awning iron close to it, inducing an electromagnetic effect, that it means a loss in our circuit. We have no means of locating that, and it is a difficult problem to tell how much of the power we are sending out is lost in that way. Therefore, we should not overlook the fact that every such induction, every such leakage, is a loss of the electricity we are making, and that electricity when it reaches that point represents quite a good deal of outlay. And while the judge cannot say it is a substance, it costs us money to make it, and we do not want to lose that.

Fred. De Land: The president in his opening address referred to the agitation of those questions that are hostile to the interests of electrical investors. The paper that has just been read by Mr. Abbott touches on one of those points. We know that if the same destructive effects on underground pipes continue, it will only be a matter of time when the authorities will say that it is better to draw the lines very closely on all electrical plants. The result will be that not only the street railways will suffer, but electric lighting and telephone companies also. As the last speaker says, let the telephone people take care of themselves; they are very wealthy. But it seems to me no company has taken care of itself quite so well as the telephone people, or is quite so willing to do so. And no company troubles other companies so little as the telephone people. As Mr. Abbott says in his paper, there is but one just solution to this problem; that is, employ a metallic circuit throughout. Educate telephone subscribers to call for a metallic circuit for the improvement in their service. The cost would be but a mere trifle over what they are now paying, and all would get excellent service. The grounding of electric light circuits is now practically unknown except in a very few places. But with the electric railways it is different. I am thoroughly in sympathy with Mr. Abbott's statement of the case. It would add very largely to the cost of construction to put in the double trolley system, but the returns in the saving that would result from the absence of leakage and the after cost for damage suits following from the corrosive action of the current upon the pipes are certainly worthy of consideration. It seems to me that Mr. Abbott has looked into this matter very thoroughly. He has been engaged on some very large engineering works. Outside of constructing one of the largest telephone engineering works of the day, he has constructed large electric railway plants in the East and a large power transmission plant. Moreover, he will shortly issue a work that will attract a great deal of attention on power transmission, probably one of the most practical works that electrical engineers have had the privilege of reading. And therefore, I move that Mr. Abbott be elected an honorary member of the Northwestern Electrical association.

[Mr. De Land's motion was seconded, put to a vote, and carried unanimously.]

Mr. Abbott: I am sure I am doubly grateful for the honor conferred upon me in so entirely an unexpected a manner. One of my friends in Chicago asked me whether I would have time to prepare a paper to present to you. At first I said no; I did not think I could spare sufficient time to prepare anything worthy of your attention. But after looking it over, and when I was assured that the paper need not be particularly scientific, as it was not desired to have the meeting overburdened with abstruse subjects, I consented to do the best I could. I am exceedingly grateful for the reception that has been accorded it.

In answer to the previous speaker I may state that I have only been a telephone man for two or three years, and so am rather green at this department of electrical work, and previously had the good or bad fortune to build about 300 miles of electric railway, some of the stations using 3,000 or 4,000 horse power. I have had some experience in electric lighting and transmission plants. Consequently I have been on each side of the fence, and perhaps from this range of experience I may be better prepared to speak with fairness to both interests. I have felt strongly electric interference from electric roads, as a telephone man; also I have been sued for damages because as a railway engineer I did not build my road well enough to keep it from injuring someone else's circuit. Having received the fire from both sides, it appears to me the way to do is not necessarily to look at the cheapest cost of construction, not necessarily to build, as a former speaker remarked, simply with an eye to what you can get out of it now, but to build as profitably as you can for your own company, and also perfectly justly, regarding the rights of everybody else to do the same thing for themselves. I think if the electric railway and lighting people will build on those plans, we will have plants which are much more profitable. They will earn more money, not because they will cost less to build, but they will be cheaper to operate and there will be no lawyer's fees, which sometimes form a very large item in all enterprises. With regard to the effect of the electric railway on the telephone plant, I endeavored in the paper not to allude in any way, excepting incidentally, to any possible question of that kind, because, frankly, although I am a telephone man at the present time, I do not think that the telephone people have any more right to the earth than the electric railway people. The fact that they happened to be there a few years earlier has nothing to do with the question. They have no right to put down a circuit which will prevent anyone else from putting down a similar circuit. And I do not think the electric railway people have a greater right to interfere. They are interfering with gas and water pipes seriously. For example, within the month after the opening of the first electric railway in Brooklyn, the city gas company lost a 36 inch water main from corrosive action. Cities will not stand that, and the electric railway people must know it. I am looking at this from a business standpoint, in one sense of the word. I want business to be better. Electrical engineers should not construct plants in such a way as to interfere with other people and make aldermen deny franchises because of spoiled gaspipes, water pipes, etc. I don't know of any way of curing that corrosive action as cheaply and permanently as providing what is equivalent to a complete metallic circuit. It may not necessarily be an overhead trolley system; it may be a conduit system with two conductors, or a road designed in such a way as to prevent the incursion of the current into other metallic structures in such a way as to injure them. The point I wish to make is that we are all in the field now, and we must each plan and execute our enterprises and maintain them in such a way as to be perfectly just to everybody else who may wish to do the same thing, whether we occupy the city streets or our own property.

## Street Railway Securities.

[From the *Chicago Tribune*.]

The Chicago Electric Transit company delivered to N. W. Harris & Co. an additional issue of $150,000 first mortgage 6 per cent. bonds, guaranteed by the North Chicago Street Railroad company. This issue is made against the construction of the Belmont avenue line. It is said this completes the present issue of securities under the mortgages of the Chicago Electric Transit and the North Chicago Electric company and the guarantees of the North Chicago Street Railroad and West Chicago Street Railroad companies. The trust deed of the Chicago Electric Transit company authorizes an issue of $2,000,000, however, but provides that no further bonds shall be issued except for the actual cash cost of permanent extensions, improvements, and betterments of the road. Above $2,000,000 no further bonds can be issued except for 75 per cent. of the actual cash cost of permanent extensions, improvements and betterments. The North Chicago Electric Railway company's trust deed authorizes a total issue of $1,000,000, but no bonds above the $300,000 already issued can be put out except for actual cash cost and permanent extensions.

In a statement made by President D. H. Louderback in February it was estimated the net earnings of the North Chicago Electric company for the current year will be $40,000, and of the Chicago Electric Transit company $45,000. As a matter of fact, the net earnings of the two companies will be greatly in excess of this estimate of $95,000. The interest on the $1,150,000 bonds now outstanding will require only $69,000. There will, therefore, be a round profit which will go to the holders of the stock in these auxiliary companies. As the value of the stock in these auxiliary companies comes to be demonstrated through earnings largely in excess of the interest requirement the stockholders in the guaranteeing cable companies will come to understand more and more forcibly how much they have lost by permitting their officers to build these lines with money raised from guaranteed bonds while they retain the stock for their own profit.

In view of the fact that the issue of bonds by these two companies is admitted to represent the cost of the lines, an excellent opportunity is offered to calculate just the cost of electric street railway construction at the present time. The Belmont avenue line of the Chicago Electric Transit company, upon which $150,000 of bonds has just been issued, is 3.3 miles in length. The Elston avenue line, upon which, including the power house, $700,000 of bonds were issued, is 5.83 miles. On the total of 9.13 miles of electric road, including a power house having a capacity of 4,000 horse power and buildings large enough to permit of doubling the capacity, $850,000 bonds have been issued, or at the rate of $93,000 per mile. The North Chicago electric is 6.75 miles long, and there have been issued $300,000 bonds, or at the rate of $44,444 a mile.

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The average traffic of the Chicago City railway last week was 260,000 passengers a day, against 240,000 a year ago. This increase of $1,000 a day in gross earnings looks satisfactory enough on the surface, but on closer examination it would seem to be positively unsatisfactory. When the increased mileage and the extensive introduction of electric motive power is taken into consideration, when it is remembered that the capital of the company is $1,000,000 larger than it was a year ago, and when one recollects that the traffic a year ago was most seriously interfered with by the great railroad strike, it is easy to see that an increase of $1,000 a day in gross earnings does not offer a prospect of a particularly fat year for the stockholders.

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"A consolidation of the street railway lines of St. Louis," said D. G. Hamilton, president of the National Railway company, "would effect a legitimate saving of $200,000 a year. Competition has been so severe there among the various companies that a great many lines are in operation unnecessarily, and a great deal of expense is incurred which would be cut off if the lines were united. We have seen the possibilities of economy through combination

in the [illegible] of the lines which make up the National Railway [illegible] is a great deal of talk about [illegible] the street railway interests in St. Louis, but we have not for some time had any definite offer for our properties. At one time we were asked if we would consider 150 for the stock, but the directors declined to go to the stockholders with that proposition."

## A Neat Exhibit.

One of the most complete and attractive exhibits at the recent convention of the Northwestern Electrical association in Chicago was that of the Western Electric company, shown in the illustration herewith. This enterprising concern, which is known in every part of the civilized world, is one of the largest electrical manufacturers in the country, and handles some of the best appliances in the market. The exhibit consisted, as will be seen, of fan motors, ammeters, voltmeters, switches, cut-outs, and the new Western Electric 25 ampere quick-break switches, which attracted universal attention. The company's new voltmeter and calibrating ammeter switches were also examined by visitors with interest. Columbia lamps and a Wagner transformer—two excellent specialties which the Western Electric company has recently adopted—were interesting features. In addition to the above, many other electrical devices were shown.

At the head of the stairs leading to the convention headquarters the Western Electric company had in operation two handsome constant potential incandescent arc lamps, which received close and critical attention from the delegates and visitors.

The exhibits were in charge of E. M. Scribner and C. D. Wilkinson, assisted by H. V. Smith, who did the honors for their company in fine style.

A NEAT EXHIBIT.

The accompanying picture should have appeared in the convention issue of July 27th, but its production was delayed by a photographer's error.

## New Telephone Enterprises.

The New Jersey Standard Telephone company of Newark is endeavoring to establish a telephone system and central station in that city. It wants 500 subscribers, at $36 per year for business houses and $12 for private residences. A new instrument made under a French patent was tested at Atlantic City and a company organized to introduce it in New Jersey. The *Camden Telegram* says: "The telephone service in this city is something awful and is the cause of more profanity than any other one thing. It is almost impossible to get a Philadelphia connection and many moments are wasted trying to call up persons in Camden. Whether the fault rests with the exchange or the management is hard to ascertain, as no attention is paid to complaints. Both business men and private parties would welcome a rival telephone company, as it would mean a cheaper and better service." The Telephone company of South Jersey has secured a franchise and intends to commence business as soon as the various rights of way are secured, and it intends to reduce the rate for telephones to both public and private subscribers. Instead of private individuals paying a rental of $60 a year as at present, it is said the new company will fix the rate at $20 per year. The new company has for its president John J. Burleigh, the general superintendent of the Camden Lighting & Heating company, and will not be a local concern, but will extend the system to all parts of New Jersey. Franchises are now being secured in different parts of the state. Ordinances are already pending before the councils of Atlantic City and Cape May.

Competition is promised Urbana, Ill., telephone subscribers, the city council having granted a franchise to the Phœnix Telephone company. The ordinance provides that the maximum rate for business and residence' phones shall not exceed $30 and $18 respectively. It also provides that the company shall supply the city free of cost two telephones for the First ward and one for each additional ward, and that any additional telephone shall be supplied at a cost not exceeding $12 a year. Section nine of the ordinance calls for a central office in the city and connections established with all outside lines. It is also provided that work shall be started inside of 60 days and completed inside of four months. According to a local newspaper, "The Central Union proposes to fight for its life, for several days ago a circular headed 'The Way It Goes' appeared on the streets. This circular contained three columns of clippings showing how the Harrison company, which put in a system at Decatur, had to throw up its hands, which statement, by the way, is not directly in line with truth. Circular No. 2 appeared a few days ago and was received by customers of the Central Union. It gives the readers warning not to infringe letters patent No. 468,569, granted to Emile Berliner November 17, 1891, for a combined telegraph and telephone, covering all forms of microphone transmitters or contact telephones."

An ordinance granting the right to place a telephone plant in Logansport, Ind., has been passed by the city council at the request of the American Electric company, represented by Ellsworth B. Overshiner. The patrons of the new company will buy their instruments, and the ordinance provides that the price for the telephones shall not be above $25. The annual rates will be $18 for a business house and $12 for a residence.

Articles of incorporation of the Home Standard Telehone company have been filed at Albany. The capital stock is $350,000. The following are the names of the directors: Hon. Henry Russell, John H. Farrell, Charles H. Whitney, W. H. Keeler, John M. Bailey, W. McM. Speer, Howard Hendrickson, Wm. Barnes, Jr., W. N. S. Sanders, W. P. Rudd, James B. Lyon, W. A. Graves, John McCarthy, James Rooney and W. J. Walker. The company will furnish subscribers long-distance transmitters. The charge will be $30 and $36 per annum or $2.50 and $3 per month. Three dollars will be charged to subscribers, except private residences, which will be $2.50. The company agrees not to raise rates for five years from date of installation of the telephone. The lines are to start from a central exchange in Albany and run to West Troy, Green Island, Cohoes, Delmar, Altamont, West Berne, Preston Hollow, Westerlo, Clarksville, Ravena, Coeymans, Cedar Hill, Bethlehem Center and other places.

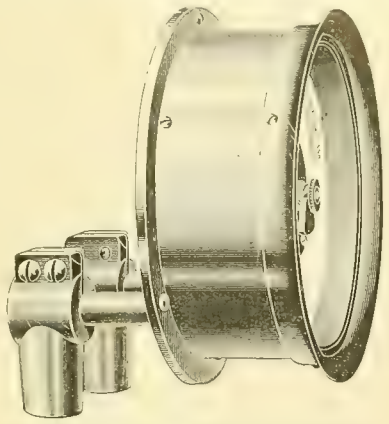
The following announcement, which is reprinted from a New York financial paper, comes under the heading of "important if true:" "A gentlemen closely connected with the new Standard Telephone company informs us that the company is actively at work erecting poles and stringing wires in many states. Work is now being rapidly pushed in Pennsylvania. Since the company came into existence, about two months ago, it has been hard at work constructing its lines, organizing offices, etc., and we expect to hear something more of it before very long."

A company of local capitalists has been organized at Lewisburg, Pa., to furnish telephone service to Union county. The capital stock will be $10,000 and an application for a charter will be made at once. Canvassers are now soliciting subscribers, in whose business houses and residences telephones will be placed. The central office will be located in Lewisburg and connections will be had with the telephone system of Northumberland county. The following are the officers of the new company: President, J. T. Baker; secretary, C. H. Hassenplug; treasurer, C. F. Shaffer. Among the other stockholders are W. D. Himmelreich, Hon. Cyrus Hoffa, Willard O. Shaffer, W. R. Follmer, France E. Brown of Lewisburg; J. K. Reish of Vicksburg, and H. B. Young of Mifflinburg.

A Buffalo paper prints a report that the Nickel Plate line from Chicago to Buffalo will be transformed into a high-speed electric railway, with trains running at a speed of 100 miles an hour.

## New Norton Switchboard Instruments.

Charles E. Norton of Manchester, Conn., has been steadily improving his voltmeters and ammeters for direct current until he now has one of the best instruments on the market for switchboard use. Among the many commendable features which these instruments possess are their accuracy, durability and neatness in appearance. They are mounted in handsomely lacquered brass and will show no heating error when left in circuit constantly. The instruments are adjusted so that the scale divisions are widest where most used, in order to give the greatest possible deflection for a given variation. The cuts show the standard type of these instruments.



NEW NORTON SWITCHBOARD INSTRUMENTS.

## Westinghouse Company to Work with the Baldwin Locomotive Works.

It seems probable that the Westinghouse Electric & Manufacturing company and the Baldwin Locomotive Works have entered into a working arrangement by which their resources will be exerted in unison to produce electric locomotives for long-distance or heavy traffic service. The details of the agreement are not made public, but it is said that the prospect of the substitution of electric power on the existing steam railroads of the country has induced the two great corporations named "to work as one company" to foster and reap the fruits of this development. A Philadelphia press dispatch says:

The name of the new company has not been determined, and the officials of the Baldwin company decline to say whether it will be made a stock company. Both plants will be retained as they are at present, extensions being made as the business warrants. There will be a division of the work, the Baldwin company taking up such as is suitable to their facilities; the electrical work will be done by the Westinghouse company. A member of the locomotive firm, in speaking of the consolidation, said: "We have been seriously discussing the matter ever since the latter part of April, and in view of the improvements which we jointly considered the electrical developments of railways to have been, we thought it to our advantage to combine our interests, and in furtherance of that policy have concluded contracts which make a practical partnership, and we are now prepared to construct electric railways and locomotives."

W. D. Updegraff, private secretary to George Westinghouse, Jr., in explaining the scope of affiliation of interests of the Westinghouse and Baldwin companies, is reported to have said:

NEW NORTON SWITCHBOARD INSTRUMENTS.

The combination is to develop the possibilities of the Tesla motor as applied to the railway service. We intend to make it possible to ride from New York to Pittsburg in three hours. With the Tesla motor we are assured of power to draw a car at the rate of 150 miles an hour or more. The only thing now is to get cars and car wheels that will stand the strain of traveling at that rate of speed. The Baldwin people assure us that this can be done. We now have the system working at our plant at East Pittsburg. I can assure you that by the year 1900, or possibly sooner, a line will be in operation between Pittsburg and

New York. The interests of the two corporations are not to be combined for anything beyond the development of the railway feature.

### Journalistic Courtesies Exchanged.

At least one of the solicited notices for the new educational-scientific-philanthropic publication which Supt. Barrett is "interested in" did not please the management of that enterprise. The article originally appeared in the *Inland Printer* and was reproduced in *Electrical Engineering*, with proper credit. Despite this fact the *Electrical Journal* holds the latter publication responsible for the article and administers this rebuke:

Our shrinking sister, *Electrical Engineering*, objects to the *Electrical Journal* as a literary production, but admires its advertising columns. We, on our part, reciprocate by admiring the literary character of our contemporary, and we have no doubt that we would admire its advertising also if it had any. We are nothing if not optimistic, and we have the happy faculty of seeing good even where others fail.

This in the first intimation the public has had of the changed relation between Supt. Barrett and the editor of *Electrical Engineering*. The latter was a most devoted admirer of the city electrician, and it will be readily admitted that very serious differences must have arisen to create such a breach as is now shown to exist. However, the article which called forth the paragraph already quoted is really interesting and for its own intrinsic merit is worthy of reproduction.

### Not The Kind of "Notice" Asked For.

[From the *Inland Printer*, Chicago.]

We are requested to editorially notice the new monthly paper, the *Electrical Journal*, just started by our well-known fellow-townsman and city electrician, John P. Barret, better known as "the old man." And right royally do we extend the publisher's hand of good fellowship, and welcome to our select membership one who brings with him the prestige as a scientist and the fame as an author that surrounds the ex-chief of the Department of Electricity of the World's Columbian Exposition. For who so valiant in standing out for the rights of the common people, so courageous in exterminating that dread disease known as "moral strabismus, superinduced by the presence of the bacilla of acquisitiveness," so progressive and enterprising in giving to the world a report of the wonders that science had gathered within the walls of her temple at Jackson Park? And that the same enterprise and the same generous spirit influences his actions to-day is clearly to be discerned by a glance through the 16 pages of advertising that appear in this his first number. How many of our publishers would have had the kindness of heart to have made a free present of 16 pages of advertising to their readers in order that there might be something in their journal that would be worth looking at?

### Costs Nothing to Get In; How Much to Get Out?

[From the *Electrical Review*.]

A new electrical publication in Chicago appears with several very creditable advertising pages. One of these advertisers writes to the *Electrical Review* as follows: "In answer to your favor of July 23d, would say that if you wish to give us an advertisement on the same terms as we get the one referred to, we will be glad to give you one also. It is not necessary to state what these terms are, but you can judge for yourselves." This is easily understood. The offer is respectfully declined.

## COMMUNICATION.

### Overhead Wires in Minneapolis.

*To the Editor of the* WESTERN ELECTRICIAN:

I wish to correct a misstatement in regard to the overhead wires in Minneapolis, given in the last issue of the WESTERN ELECTRICIAN by the Minneapolis correspondent.

While the "overhead wire nuisance" is not yet by any means overcome, still it is far from the truth to say that it is growing worse, as these few facts will show:

Since January 1, 1895, one company alone has removed from the subway district over 200 miles of wire. One of the lighting companies has taken down every inch of its overhead wire, excepting in one place where three wires temporarily cross a side street. The other lighting company has laid many miles of conduit, is at present engaged in drawing in cables, and will soon be in shape to cut down its aerial lines. Most of the companies owning overhead wires are slowly complying with the requirements.

The time granted to the companies for removing their wires has not yet expired.

CHARLES L. PILLSBURY,
Electrical Inspector.

Minneapolis, August 5, 1895.

## CORRESPONDENCE.

### New York Notes.

NEW YORK, August 3.—It is reported that Mayor Strong will sign the resolution providing for the sale of a franchise for a street railway system covering about 27 miles of street in the territory above the Harlem. This resolution was adopted by the Board of Aldermen on the application of the company known as the People's Traction company, of which Francis C. Wilcox, a large property owner in the territory through which the new road will run, is president. There has been much talk of the use of money in connection with the granting of this franchise. This talk has kept the mayor from signing the resolution until now, though it was passed by the Board of Aldermen before he went on his vacation. His determination to sign the resolution was arrived after a conference with the members of the aldermen's railroad committee and a subsequent talk with Mr. Wilcox and others who are interested in the petitioning company.

The General Term of the Supreme Court, in the appeal from the judgment of Justice Walter Lloyd Smith, setting aside the franchise of the Nassau Electric and Kings County Electric Railroad companies, generally known as the Flynn roads, upsets Justice Smith's decision and upholds the contentions of the companies on all the points raised in the protracted litigation. The privilege of operating nearly 50 miles of trolley lines within the boundaries of Brooklyn and the little town of Flatlands, which now embrace the entire territory of Kings county, was involved. Large financial interests were at stake. In the fall of 1893, directly after the Board of Aldermen, by the vote of the so-called "cold thirteen," had granted the Flynn people a franchise, work on nearly all the lines was begun, and about $3,000,000 had already been expended when, a few months ago, the sweeping decision of Justice Smith put a sudden stop to all operations, the city authorities revoking all the permits they had granted. Work was resumed quickly, for an hour after the decision of the General Term had been handed down judgment was entered. President Flynn had within another hour a thousand men at work on the lines. Some of the lines are now in operation, but six months, will probably elapse before the extensive trolley system can be completed. The company promises to carry passengers over all the lines for a single fare of five cents.

A coroner's jury in Brooklyn, in a recent fatal trolley-car accident, found the Atlantic Avenue Railroad company "criminally negligent and wholly responsible for the death of this child in not properly equipping their cars with suitable fenders." The fender agitation is increasing in force.

The Edison Electric Light company of Newburg, N. Y., which the General Electric company lost control of not long ago and then, through the aid of the courts, regained, was on Wednesday consolidated with the opposition company, the Newburg Electric Light & Power company. When the Edison was placed back under the control of the General Electric all local interest in it ceased. Congressman B. B. Odell, Jr., who has long sought to consolidate the two opposing companies and was president of one of them, then stepped in and with others bought a majority of the Edison stock, elected their own board of directors and submitted the scheme of consolidation to the stockholders. The agreement includes the capitalization of the new company at $250,000. It is to be known as the Consolidated Gas, Electric Light, Heat and Power company of Newburg.

The Atlantic Coast Seashore Electric Railway company opened its tracks between Asbury Park and Elberon on July 31st. Two cars were run. Among the invited guests who made the trip were H. H. Vreeland, president of the Broadway Cable company, New York; John P. O'Brien, of the Metropolitan Traction company; O. O. Beebe, New York; Colonel G. B. M. Harvey, the president of the new road; Mayor Frank Tenbroeck of Asbury Park; James J. Corbett, the pugilist; T. S. Darlington of Darlington; Asbury Park town officials and a number of newspaper men. The road will be opened through to Pleasure Bay in a fortnight.

By an automatic clockwork switch the bronze group on the *Herald* building, including the bell and bell strikers, is now illuminated at night just as the hour is struck. The light from 145 sixteen candle power lamps, placed in a circle at the foot of the group, throws the figures in bold relief.

A. G.

### News from the National Capital.

WASHINGTON, D. C., August 3.—The electric supply people seem to be marked as victims of the illegalities of the officials of this government who make some of its contracts. The action of the public printer in discriminating against the general industry of electrical appliances in favor of three or four well-known and reputable concerns, which were allowed to bid on a call for proposals which might properly be termed a secret invitation, calls forth much comment. Even the exclusiveness of the action did not protect those thus favored, however, for the contract was divided up, much to the disgust of some of the bidders. There developed, too, a carelessness in the consideration of the bids, which went very well with the disregard of law and custom shown in securing the original proposals. The work included a lighting and power plant for the government printing office, and no satisfactory explanation of the situation has been presented. It was plainly the desire of the public printer to limit bidding, and this intention appears to have passed for sufficient authority for an unwarrantable act. Now, it appears that a large contract will be, or has been, let to one firm without competition, the action being taken presumably by a congressional committee, or that remnant of it which remains in power. There was needed an equipment of dynamos for electric lighting in the Senate wing of the capitol building, and the work was estimated at between $40,000 and $50,000. No bids were asked for this work, even in the limited and exclusive fashion popular with the public printer, and there appears to have been at the capitol even less regard for the requirements of the law than was exhibited at the printing office. There was only one bidder invited to present a proposition for furnishing the dynamos at the capitol, and the contract has been awarded that concern in the sum of $35,000. In this connection it is pertinent to once more print the law relating to the awards of contracts. There will be found in the Revised Statutes, section 3709, the following paragraph:

All purchases and contracts for supplies or services, in any department of the government, except for personal services, shall be made by advertising a sufficient time previously for proposals respecting the same, when the public exigencies do not require the immediate delivery of the articles or performance of the service. When immediate delivery or performance is required by the public exigencies the articles or service required may be procured by open purchase or contract, at the place and in the manner in which such articles are usually bought and sold, or such services engaged, between individuals.

There can be no doubt of the purpose of this section. Its meaning is conveyed in plain language, and no amendments to it which affect the duty of the purchasing officials of the United States capitol can be found. In the purchase of stationery for the Senate and House of Representatives annually, it is the practice of the officers to make the award without much regard to the lowest bidder. There is no attempt to exclude bidders and there is an apparent desire to secure as general and numerous bidding as possible. Why should there be a departure from the custom when dynamos are to be secured? So far as the law goes, electrical machinery bears the same relation to the exactions of the statutes as does writing paper or pencils, and unless there is some valid reason for haste, time should be taken to secure bids from all those who believe they are able to do the work, or who are able to give a guaranty with their proposal that they are serious in their bids. There is no indication on the surface of an emergency for the dynamos in question. In fact, as Congress does not assemble for more than four months yet, and as during the intervening period there is virtually no occupation of the capitol building, it must be assumed that such an emergency does not exist. The law as quoted was enacted to prevent the making of secret contracts which at one time under the Navy Department became a scandal tainting the administration which tolerated it. There is as much reason for protecting the public treasury from secret contracts made by the capitol officials, as there ever was in any department at any time. The question of machinery equal in power, and as satisfactory in performance, does not appear in the matter.

The movement inaugurated by President John M. Berger of Local Union No. 26 of Electrical Workers of Washington, to have the approaching convention of the National Brotherhood of the order held in this city is meeting with much encouragement, and has secured one friend at least in the executive board, which has final control of the matter, as a letter from Secretary-Treasurer J. T. Kelly, which has just been received by Mr. Berger, will show. "As far as I am concerned individually," writes Mr. Kelly, "I would like to see the convention in Washington, as I have never had the pleasure of visiting our capital city, and should like to take the trip. However, this will rest entirely with our unions. I would suggest that No. 26 send in a formal request for the convention and also that you present a few reasons in your communication why the convention should be held in Washington. This would probably call the attention of some of our unions to the advantage of holding a convention in Washington who would otherwise be indifferent as to where the convention would be held." Mr. Berger has also received a letter from the commissioner of the Central Trunk Line Traffic association assuring him that the usual reduction of rates will be accorded to the delegates and all others who desire to attend the convention.

In the matter of the protest of G. W. Sheldon & Co. against the decision of the collector of customs at Chicago on certain imported merchandise, General Appraiser Sarretts has rendered the following opinion: "The merchandise is electric light carbon, and these carbons were classified by the collector as included in the terms of enumeration in paragraph 86 for articles composed of earthen or mineral substances. The appellants claim in the protest that the merchandise is not enumerated or provided for denominatively or by minerals in the present act, and hence it is not dutiable at 20 per cent. ad valorem, in accordance with the provisions of section three of said act. The chemist of the

United States laboratory at New York reported that the sample of carbon submitted to them by the board, and which was a part of the importation in question, contained 60 per cent. of manufactured carbon. In determining these cases we have only to decide whether the carbon of which the merchandise is composed is a mineral substance. The board has made an exhaustive investigation upon this point in question, and finds that the carbon points in question are articles composed of mineral substances. The protest is accordingly overruled and the collector's decision affirmed."

W.

## Northwestern Notations.

MINNEAPOLIS, August 3.—The board of equalization has finally assessed the franchise of the Minneapolis Street Railway company at $100,000 and that of the Minnesota Electric Subway company at $1,500, the Minneapolis General Electric company at $30,000 and the International Electric company at $13,000. Attorneys appeared for all of these companies and fought the proceedings bitterly. These figures are a reduction of $100,000 on the street railway franchise from what the assessor first proposed.

The Iowa Insurance Alliance has appointed W. C. Stewart, formerly wire inspector for St. Joseph, Mo., to inspect the wiring in insured buildings in the state. It is reported that there is a great deal of poor work throughout the state and the result will probably be an increase in rate of insurance.

The last Montana Legislature passed a law taxing telegrahic instruments $20 per annum, and a test case has been brought against the Western Union Telegraph company at Helena to compel the payment of $60 tax for one quarter on 12 instruments. The contest is made on the ground that the law is against the interstate commerce law. There was formerly a tax of $1 per annum, which was paid without protest.

The electrical workers of the Edison company at Spokane, Wash., recently presented J. B. Fisken, late superintendent of that company, a handsome gold chain and locket.

The Tilloston franchise for an electric road at Oshkosh, Wis., is subject to forfeit at the pleasure of the council, as work has not been done as agreed.

The Omaha Street Railway company is changing the track of the Lake and Thirtieth streets line to electric.

Boone, Ia., will have electricity substituted for mules as a motive power on the street cars.

Stockholders of the electric lighting and water company at La Porte City, Ia., have voted to begin work at once on their plant.

The state board of equalization for South Dakota met recently to assess telephone and telegraph companies, but, on account of the absence of members, adjourned until the first Monday in August.

The Postal Telegraph company has been granted a franchise to run its system through the city of Clinton, Ia.

The Iron River Electric Light, Power & Telephone company has been incorporated at Iron River, Wis., with $20,000 capital stock.

The Electrical Insulation company of Chicago has the contract for equipping the Fort Madison, Ia., Street Railway company's system for electricity. The cost will be $40,000.

Aitkin, Minn., has begun excavation for the power house for an electric light plant. The company will buy a plant and have an expert put it in instead of having a competition.

It is rumored that Thomas Lowry, the street car magnate, will buy the exposition building in Minneapolis and utilize the lower floors for a storage room and work shop, with amusements above.

## PERSONAL.

Col. S. G. Booker, superintendent of the Phœnix Carbon Manufacturing company, St. Louis, was in Chicago last week.

At a meeting of the Owatonna, Minn., Electric company, held July 31st, G. E. Hall, formerly of the West Duluth Electric company, was elected secretary and treasurer and will assume full management of the company.

Frank B. Rae, the electrical engineer, has joined the Chicago contingent and will hereafter be counted among the residents of the city. Mr. Rae has taken an office in the Fort Dearborn building, and he will be heartily welcomed by the fraternity.

George K. Hooper, for three years agent and engineer for the Abendroth & Root Manufacturing company of New York, has resigned to accept a responsible position with the Deering Harvester company of Chicago. He entered upon his new duties August 1st.

Dr. Charles Lemon, late superintendent of posts and telegraphs in New Zealand, was presented a silver tea and coffee service by the officers of the department as a mark of esteem on his retirement from official position. Dr. Lemon was connected with the department for over thirty years and built up an efficient telegraphic and telephonic service. As an appreciation of his assistance to an astronomical party sent to observe the transit of Venus, Hamilton College conferred upon him the degree of Ph. D.

Dr. Alexander Macfarlane, formerly professor of physics in the University of Texas, has been appointed lecturer of engineering in Lehigh University. In speaking of the appointment, the *Philadelphia Press* says: "Dr. Macfarlane's reputation as an investigator in mathematical physics is an international one, and his discoveries in electricity have caused him to be elected to honorary membership in several European societies. Lord Kelvin, president of the Royal Society of London, has spoken in high terms of his analysis of the phenomena of the electric spark. Dr. Macfarlane is the author of a work on physical arithmetic and of several papers on the algebra of physics. His adaptation of quaternions to the solution of problems in electricity has gained for him high rank in mathematical circles. For these important researches he received from the University of Michigan the honorary degree of doctor of laws. Valuable papers on alternating currents and on heat conduction have been read by Dr. Macfarlane before the American Institute of Electrical Engineers and have been recently published in its Transactions. A series of ingenious models illustrating the application of quaternions to the solution of electrical and physical problems was exhibited by him at the World's Fair, and received an award."

## ELECTRIC LIGHTING.

The Phœnix Light & Fuel company and the East End Electric Light company of Los Angeles, Cal., have combined. The East End, or Gardiner works, were sold to the Light & Fuel company. The sale will go into effect the 18th of August. The Gardiner plant will be removed to the opposition works on First avenue.

The Bay County Electric company has refused to accept the offer of the city council of Bay City, Mich., to light the city at $75 per annum per arc light. The electric light committee was instructed to confer with the electric light company regarding street lighting. Alderman Ray declared that he believed the company could light the city at the $75 offered. To compel the company to come down in its price Alderman Anderson secured the passage of a resolution ordering street lights discontinued until a contract was made with the company.

## ELECTRIC RAILWAYS.

A plan is on foot for the building of a six-mile electric railway from Mexia to Tehuacana, Tex.

An electric railway is projected to connect Auburn, N. Y., with the adjacent villages of Skaneateles, Port Byron and Weedsport.

The Herkimer, N. Y., Mohawk, Ilion & Frankfort electric railway has just been opened with a grand celebration. The line is completed from Herkimer to Frankfort.

It is announced in Richmond, Ind., that an electric railway touching the principal places in the counties of Wayne, Fayette and Union is assured. The route is to begin at a point in Richmond, run to Connorsville, thence to College Corner, O., thence to Liberty and back to Richmond. This will make a line 65 miles in length. The estimated cost is $700,000. The road will carry freight as well as passengers.

## MISCELLANEOUS.

An English paper claims to know of a sportsman who reports from Calcutta that he uses the electric light in hunting tigers at night. He sits on a raised platform in the jungle and suspends a five candle power incandescent lamp over the bait, which is placed about 30 feet away. Batteries supply current for the light. A switch on the hunter's rifle enables him to throw on the light when he is ready to shoot. The light tends to temporarily blind the tiger, and a good shot can be had before his eyes become accustomed to it.

## TRADE NEWS.

General Sales Agent F. S. De Ronde of the Standard Paint company, New York, is visiting Chicago on a business trip. Mr. De Ronde is having his usual success in securing orders for P. & B. products and prophesies an exceptionally fine business for this fall.

James Murtland, who for a long time was chief clerk for the Pennsylvania Electric Engineering company of Philadelphia, has recently established an office in the Betz building, Philadelphia, where he will take up a line of electrical novelties. He is well known to the electrical fraternity in that vicinity and will undoubtedly succeed.

The Electric Appliance company, Chicago, reports something startling in the dry battery line, having taken the general western agency for the "American Flag" dry battery. The "American Flag" is claimed to be a decided step in advance in the manufacture of dry batteries, and is claimed to be superior in the volume of current and staying powers to the best open-circuit batteries, wet or dry. For telephone work it is said to be without an equal and is being extensively used. It is made in three sizes, filling the demand for a small pony battery or for a cell of extra large volume.

The Borden & Selleck company, 48-50 Lake street, Chicago, has recently closed contracts for Harrison conveying and elevator machinery as follows: The coal storage plant and for conveying coal from cars to the two batteries of boilers for the Toronto Street Railroad company, Toronto, Ont., the contract including a large crusher for crushing bituminous coal; coal handling plant for J. F. Clancy & Co., Racine, Wis.; coal conveyors and elevators for C. P. Wilder & Co., South Chicago, Ill.; coal conveyors and elevators for E. L. Hedstrom & Co. at their new Thirty-first street yard; coal conveyors for handling coal to boilers, including storage tanks, also power crusher for the Northwestern Electric Transit company, North Chicago power house. Business is reported as improving and the factory is running to its full capacity.

The Hobart Electric Manufacturing company is about to remove from Middletown to Troy, O. The *Signal* of Middletown says: "For several weeks negotiations have been pending between the Hobart Electric Manufacturing company of this city and the Troy Land Improvement company of Troy, O., with a view to the removal of the former concern to Troy. The deal has at last been completed and within 60 days the Hobart company will leave for Troy. The Troy Land company has offered flattering inducements to the home company and the latter has been presented with a two-story brick and stone building 115 by 50 feet in size, a deed for four lots and $10,000 in cash. The concern will begin operations in Troy with 100 employes and will do business on an extensive scale. By this change Middletown loses a very valuable manufacturing concern and two very progressive citizens in the persons of C. C. Hobart and Prof. J. L. Orr, the latter gentleman having recently become a partner in the concern. The work of removal has already been begun."

## BUSINESS.

Fred Brainard Corey has removed his office from 620 Atlantic avenue, Boston, to room 33, 150 Devonshire street, in the same city, where he will continue his practice as an electrical expert.

The American Reflector & Lighting company of 271 Franklin street, Chicago, manufactures the Paragon reflectors for all illuminants, as well as other specialties, such as street hoods, blow pipes, stage dimmers, theatrical lamps, etc. A recent price-list gives all information.

The coming autumn will bring with it a new catalogue of the Bryant Electric company's specialties. The managers of the western office in Chicago, Thos. G. and Edward R. Grier, are at work on some new devices. The new catalogue will enumerate many more specialties than in the present edition, and all users of electric supplies should have one.

"Buckeye incandescent lamps are moving right along," says J. H. Cooke, the Chicago representative. "Within the past 30 days improved methods of manufacturing have been adopted, which improve in certain ways the already acknowledged superior all-round service capacity of the lamp. It is intended that the Buckeye shall continue to set the pace."

Electrical companies or municipal authorities contemplating underground construction for electrical conductors can gain much valuable information by consulting the fine pamphlet on the subject issued by the National Conduit Manufacturing company, Times building, New York. The large illustrations add greatly to the value of the work. The "Trilby" picture is amusing as well as instructive.

Many of the most prominent steam users of the country, such as the New York Central Railroad company and the Pullman company, employ the air space coverings for boilers and steam pipes made by the Globe Paper & Fiber company of Brownville, N. Y. This company has a well deserved reputation for its asbestos and felt products, and is represented in Chicago by C. E. Schauffler of 737 Monadnock block.

The Central Electric company is constantly on the alert for improved devices of various kinds, to the end that it may offer to the trade the latest, most feasible and satisfactory articles that can be procured. It is selling quantities of the Billings & Spencer commutator bars and overhead material, and these lines are acknowledged by railway people to be of superior quality. The company carries a full complement of samples of all of this material, and prompt shipments are made from stock.

Roth Bros. & Co., 30-34 Market street, Chicago, who were recently delayed a few days owing to a small fire in their shops, are again prepared to fill orders with their accustomed promptness. This concern, though comparatively a new comer, has gained an excellent reputation among the trade, and is manufacturing dynamos and motors which are said to give perfect satisfaction. They report the outlook for fall trade as being to them unusually bright, and have no complaint to make of the orders already on hand.

Word has just been received to the effect that the management and control of the Commercial Electrical Supply company of 821 Pine street, St. Louis, Mo., has been changed, the Messrs. Einstein, who have heretofore held the control of this company, having disposed of their entire interest in it to Jos. Franklin and his son, Jos. Franklin, Jr. The Commercial company is now officered as follows: Jos. Franklin, Jr., is president, with Jos. Franklin as secretary and treasurer. The new management is now issuing a general circular to the electrical trade, thanking customers for their past favors and stating that through the concern's increased facilities it proposes to extend its business through a greater territory. It is also pointed out that the company will pay particular attention to shipping the best goods promptly and at the lowest prices.

The Clayton Air Compressor Works, Havemeyer building, New York, have issued a fine new catalogue containing a new feature, never before attempted in a gratuitous work of this kind, being an illustrated article upon the "Widening Use of Compressed Air," in which reference is made to all of the various employments of compressed air power up to the present time. As specialists in the construction of air compressing machinery, with an experience covering twenty-five years, the Clayton people are now realizing the fulfillment of their prophecy made years ago, for the field of usefulness of compressed air has extended beyond their greatest expectations and is still enlarging. The catalogue also contains complete illustrations and price-lists of every style of air compressor and gas compressor made by the company, together with tables and data of value to all interested in compressed air. It is issued for general distribution and copies will be furnished free upon application.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued July 30, 1895.*

543,490. Contrivance for Disinfecting Telephone Apparatus. Rudolph Lamarche, Hamburg, Germany. Application filed July 24, 1894.

The accompanying cut shows a contrivance for the disinfection of telephone apparatus, comprising a tube in the form of an annular ring placed at the mouthpiece of the telephone, the tube having a number of perforations, and being provided with a rubber ball connected thereto for the reception of the disinfecting materials.

543,495. Electrical Controlling System for Elevators. Cyprien O. Mailloux, New York, N. Y. Application filed May 28, 1895.

In this arrangement there is a controlling switch at each landing for calling the car to that landing, and duplicate switches corresponding to the controlling switches are also placed at other landings, whereby the car may from one landing be directed to any of the others.

543,502. Electric Arc Lamp. Samuel E. Nutting, Chicago, Ill. Application filed April 5, 1894.

This is an alternating current arc lamp, and there is claimed the combination with an electro-magnet in circuit with the lamp, of an armature co-operating with the magnet, and adapted to control the carbon feed of the lamp, the magnet and armature being so related that the induced counter-electromotive force of the magnet varies with the changes of position of the armature, whereby the current supplied to the lamp is regulated.

543,523. Starting or Stopping Device for Electric Motors. Jonathan P. B. Fiske, Alliance, O. Application filed November 14, 1894.

A fixed motor frame, a movable field magnet frame, a rheostat, a contact shoe, and connections between the shoe and frames, whereby the torque of the movable field magnet frame will automatically operate the shoe and cause it to pass over the contacts of the rheostat.

543,524. Device for Automatically Operating Brakes and Rheostats. Jonathan P. B. Fiske, Alliance, O. Application filed December 6, 1894.

The motor is constructed and adapted to move bodily in response to the increase or decrease of the amount of load put upon it. Starting and stopping devices are connected with the motor and operated by the movements thereof.

543,525. Electric Motor and Brake Mechanism Therefor. Jonathan P. B. Fiske, Alliance, O. Application filed February 9, 1895.

NO. 543,490.

A stationary frame, a field magnet frame made in two parts removably secured together, yokes projecting from the field magnet frame, each yoke being made in two parts, the respective parts of the yokes projecting from the respective parts of the field magnet frame, and trunnions projecting from the yokes and mounted in the stationary frame

543,529. Electric Trolley. George W. Hooper, Rochester, N. Y. Application filed September 11, 1894.

This device comprises a yoke, having transverse openings in its ends, a wheel having a rigid hollow shaft, hollow bushings extending inward through the openings, and receiving and forming bearings for the rigid hollow shaft and held against inward movement in the yoke, and a clamping bolt passing through the shaft and bushings for uniting them and holding the ends of the yoke against spreading.

543,544. Electric Car Brake. George B. Damon, Lowell, Mass. Application filed April 9, 1894.

Electric motors are directly attached to and operate the blower for producing pneumatic pressure in a system of air brakes.

543,559. Signaling Apparatus for Telephone Exchange Circuits. Joseph J. O'Connell, Chicago, Ill. Application filed May 14, 1895.

Claim one reads as follows: The combination of a main telephone circuit, two local signal circuits at a station thereof, each including a visible signal, a switch socket for the said main circuit, and a switch plug therefor, a relay contained in the said main circuit and adapted to respond diversely to current impulses of opposite directions circulating therein, and circuit opening and closing switches at two points of each signal circuit, so arranged that the signals of either of the said circuits can only be displayed when such circuit is closed at both points, one switch of both circuits being controlled by the said relay, and the other by the switch socket and plug.

543,591. Railway Signaling System. Thomas B. Dixon, Henderson, Ky. Application filed November 17, 1892.

In an electrical railway signaling system, the combination with a block or section of track, of a track instrument, governor, and a local closed circuit battery at one end of the block, and a governor closed circuit passing through the governor magnet and normally closed contact points of the governor and track instrument.

543,592. Electrical Railway Signaling System. Thomas B. Dixon, Henderson, Ky. Application filed October 5, 1893.

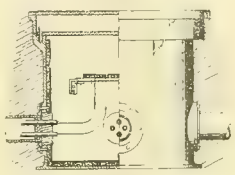
In this arrangement there is the combination with two insulated blocks or sections of track, an electrically controlled signal for each block controlling the entrance of trains thereto, a signal circuit for each block controlling the signal of that block and passing through the rails of said block, a signal battery for each signal circuit, means for throwing the signal battery of each block into or out of its signal circuit, thereby setting to safety or to danger the signal of that block, and a circuit controller operated from the entrance of the second block and controlling the signal circuit of the first block, and arranged to set to danger or to hold at danger the signal of the first block when a train is entering the second block.

543,594. Electrical Railway Signaling System. Thomas B. Dixon, Henderson, Ky. Application filed July 10, 1894.

An insulated block or section of track, and an electrically controlled signal controlling the entrance of trains to the block at one end thereof, a battery at the distant end of the block, and a signal circuit therefor passing through the rails of the section of track and controlling the signal at the home end of the block, the battery being normally out of the track circuit.

543,595. Electrical Railway Signaling System. Thomas B. Dixon, Henderson, Ky. Application filed August 20, 1894.

The features of this invention are: Two or more consecutive blocks or sections of track, a track instrument at the entrance of each block, and a register for each block provided with registering and canceling mechanisms capable of simultaneous and independent operation of a separate registering circuit for each register, controlling the registering mechanism of that register and operated by the track instrument at the entrance of the block to which that register belongs, a separate canceling circuit for each register controlling the canceling mechanism of that register and operated by the track instrument at the entrance of a succeeding block, and batteries or other sources of electrical energy for said circuits.



NO. 543,613.

543,596. Electrical Railway Signaling System. Thomas B. Dixon, Henderson, Ky. Application filed August 20, 1894.

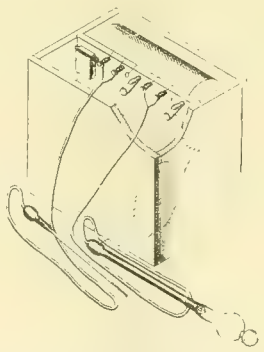
One claim reads as follows: In an electrical railway signaling system, the combination with a block or section of track, signals for the ends of said block, a line circuit for the block, a line battery for each end of the block, and a circuit controller or switch for each end of the block connected to the signal and to the battery of that end of the block and to the line circuit conductor, and adapted to place either said signal or said battery in circuit with the line circuit, of a register at each end of said block arranged to register the passage of trains into said block and to cancel the passage of trains out of said block, and means operated by said registers for controlling said signals, and adapted to hold said signals to danger while a train is registered on said registers.

543,597. Track Instrument. Thomas B. Dixon, Henderson, Ky. Application filed August 20, 1894.

In a track instrument two sets of contact points and a swinging arm are arranged to operate the one set or the other according to the direction in which the arm swings; two magnets, each arranged when operated to tend to cause the arm to swing, the magnets acting to swing the arm in opposite directions, circuits for operating the magnets arranged to be operated by a passing train, and to cause the magnets to be operated successively, and a locking device arranged to hold the pivoted arm in the position in which the magnet first operated placed it while the second magnet is acting on the arm.

543,613. Manhole for Underground Conduits. James F. Cummings, Detroit, Mich. Application filed November 6, 1894.

The cut shows a manhole for electric conduits, in which there is the combination of a cylindrical outer box provided with an enlarged top formed with a plurality of seating flanges, the covers supported by the flanges, the inner box supported by insulating studs within the outer box, the insulating material contained between the walls of the boxes and the removable switchboard freely supported from the walls of the inner box centrally near its top.



NO. 543,616.

543,616. Internal Illuminator and Probe. Willard E. Dow, Braintree, Mass. Application filed February 16, 1895.

The apparatus described includes a lamp, a conducting tube, in the end of which the lamp is mounted, the tube constituting one conductor for the lamp, a second conductor within, but insulated from the conducting tube, and terminating in a contact at the end of the tube; two flexible conductors and a socket at the end of the same connected with one of the conductors, and adapted to receive the end of the conducting tube, and a contact within the socket and connected with the other flexible conductor, and adapted when the tube is inserted in the socket to co-operate with the tube contact, whereby a complete circuit is established.

543,653. Electric Brake Shoe. William B. Potter, Schenectady, N. Y. Application filed March 30, 1895.

An electric brake shoe consisting of a magnet arranged about a car axle and suspended by a single spring-cushioned bearing above the car axle.

543,654. Electric Soldering Iron. Frank B. Rae, Detroit, Mich. Application filed September 18, 1894.

The main features of this invention, as shown in the cut, comprise the combination with a revoluble bracket, of a supporting standard on the bracket, a soldering iron on the bracket located laterally to one side of the standard and adapted to circle about the same, electric conductors to the iron, and a swivel contact device therein.

543,673. Process of Extracting Precious Metals from Their Ores. Middleton Crawford, Colorado Springs, Colo. Application filed October 29, 1894.

The process consists in dissolving precious metals in a cyanide solution separating the metals from the solution, and exposing the entire solution to an electric current in the region of the anode only prior to using it over again.

543,707. Electric Clock Winding Mechanism. William S. Scales, Everett, Mass. Application filed November 12, 1894.

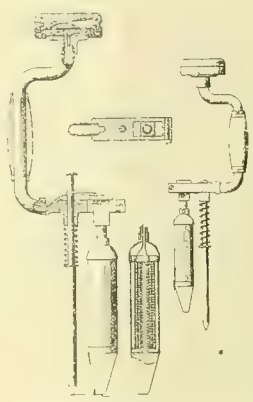
The train and actuator are combined with a winding device for the actuator, comprising an electro-magnet, its vibrating armature, an arm projecting from a shaft connected with the actuator, and moved by the armature to wind the actuator, and a balance wheel connected with the arm, which continues to wind the actuator by its momentum, a pawl carried by the arm, a ratchet wheel engaged by it, and a spring flexibly connecting the ratchet wheel with the train.

543,708. Telephone Exchange. Wada Y. Shibata, San Francisco, Cal. Application filed November 24, 1893.

Claim 1: In a telephone exchange, the series of parallel non-conducting bars, independent insulated metallic plates fixed thereto, toothed tracks extending transversely across above the sets of metallic plates, cars adapted to move across said tracks, arms depending from said cars upon opposite sides and adapted to form contact with plates in two different lines, and conducting wires connecting the sets of plates with each other in independent groups, and connecting with the exchange subscriber, and interrupting non-conducting sheets movable over the bars to prevent contacts while a car is being moved forward.

543,721. Signaling on Railways and Means Therefor. Edwin Blakey, Bradford, Eng. Application filed June 11, 1894.

A main circuit, extending from a point in advance of the signal to the end of the section controlled by the signal, a single needle circuit containing single needle instruments, one at each end of the section, a local circuit containing the signal, a signal circuit containing a relay for closing the local circuit, a polarized relay in the single needle circuit, a relay in the main circuit, and a key in the signal circuit, relays and key serving to control the closing of such signal circuit, and consequently the operation of the signal, means for causing the train to lock the needles of the instruments at "train on line" as it passes along the section, and means for causing it to open the main circuit when approaching the signal, and to close such circuit on leaving the section.



NO. 543,654.

543,729. Electric Arc Lamp. Charles E. Harthan, Lynn, Mass. Application filed November 21, 1894.

Included in the claims for this invention are these features: A coil, a core actuated by the coil, feeding mechanism for the lamp operated or controlled by the core, and a spring arranged to progressively assist the action of the core.

543,785. Railway Signaling. Jens G. Schreuder, Edgewood Park, Pa. Application filed March 28, 1894.

In a signaling system, the combination of a track circuit, a differentially wound relay, the winding in one direction being greater than that in the other direction, the greater coil being included in the track circuit, and a normally closed signal circuit controlled by the relay, and including therein the lesser coil of the relay.

543,798. Telephone. Norval L. Burchell, Washington, D. C. Application filed October 29, 1894.

One claim is: In a telephone, the combination with a pivoted arm and with a switch connected to and operated by said arm to complete the telephonic circuit, of a transmitter carried by an arm projecting laterally from the pivoted arm, and adapted to turn thereon to bring the transmitter upon either side thereof, said transmitter having a granulated conducting material for its variable resistance medium, whereby said transmitter is necessarily changed in position when the telephone is used, and may be inverted, thus changing or reversing the gravital relations of the granular material.

543,800. Electric Heating Rug. Jesse R. Davis, Parkersburg, W. Va. Application filed July 11, 1894.

The invention comprises a flat layer of electric heating medium of amorphous resisting material, a ring-shaped electrode of triangular cross-section, having its flat face uppermost, a second electrode of conical shape arranged with its base uppermost and in concentric relation to the ring, both being arranged in the same plane in the heating medium, and an insulating casing with flexible covering.

543,824. Electro-deposition of Alloy. Henry J. Altman, New York, N. Y. Application filed April 12, 1894.

As an improvement in the art of electro-plating with alloys of platinum, the process consists in forming a suitable bath containing a chloride of platinum and the sulphate of the other metal or metals desired in the alloy to be electro-deposited, immersing in the bath as a cathode the article to be plated, and an anode composed of an alloy of the metals to be electro-deposited, and finally passing an electric current through the bath.

# Western Electrician.

EVERY SATURDAY.

Vol. XVII. CHICAGO, AUGUST 17, 1895. No. 7


## Motor Cars for Chicago's North Side Loop Lines.

In equipping the horse car lines of the North and West Chicago street car systems electrically the management found many perplexing problems confronting it, owing to the peculiar local conditions that existed. In addition to the cross town lines like those of North and Chicago avenues that were feeders for the cable system, there were many lines that were operated partly by horses and partly by cable. One of these that will serve as an illustration was the North Halsted street line. The cars on this route were drawn by horses from the intersection of Clybourn avenue north to the end of the line at North Clark street. From Clybourn avenue south, however, they were drawn by cable as trailers on the Clybourn avenue cable trains. When the management decided to introduce the trolley system on these horse car lines it was determined not to equip each individual car electrically, but to build a number of small electric locomotives which would run over the sections of the road formerly operated by horses. For instance, the trailer on a north-bound Clybourn avenue train would be dropped at Halsted street and from that point drawn by the electric locomotive to the northern terminus of the line at North Clark street and back again to Clybourn avenue, where it would once more be hooked onto the cable train and pulled down town. The same plan was adopted upon the loop lines connecting with the Lincoln avenue cable. At Fullerton avenue the Lincoln avenue cable train drops the Fullerton and Webster avenue trailer, which is immediately taken up by one of these motor cars and pulled around to Webster and Lincoln avenues, where it is once more attached to the cable train and hauled down town. A similar arrangement has been made on the Garfield avenue and Center street loop, which is also connected with the Lincoln avenue cable line.

This plan, it is found, has many advantages over that of equipping each car with motors. In the first place a considerable saving is effected. With individual motor equipments the investment in electrical apparatus would be much greater. Then, too, the cost of reconstructing old cars to fit them for service as trolley cars would be considerable; in fact, the company finds that there is very little if any real economy in transforming horse cars into trolley cars. An item of considerable importance, too, is the "dead time" of the motormen, or the time consumed in drawing the trolley car over the cable line. Where each car is separately equipped the company finds it necessary to employ a motorman for each trolley car, and of course it is necessary to pay for a large amount of time from which the company derives no benefit. Then, too, trolley cars have to be built much stronger and heavier than ordinary trailers and the weight of electrical machinery is considerable, making a very noticeable addition to the load on the cable station.

After giving the subject considerable attention, the officers of the North and West Side companies decided to introduce these small electric locomotives on several lines, and they are now building 100 of them for immediate service. The cut on this page will give an excellent idea of the appearance of these motor cars. The illustration shows a motor car and trailer south-bound on Halsted street, near the corner of Belden avenue, directly in front of the McCormick Seminary. It was upon this loop—Webster, Racine, Fullerton, Halsted—that so many experiments with different forms of locomotives and means of propulsion were made. It is a singular fact that the first of these little electric motors was built upon the truck of one of the old Belgian gas locomotives which Mr. Yerkes tried upon this loop, but which was discarded. It is said that this arrangement was intended only as a makeshift until the engineers of the company could devise a permanent plan for operating these lines. No sooner had the arrangements been given a trial than its many admirable features were recognized and it was decided to develop the idea. There is nothing novel about the equipment as far as the electrical features are concerned. The standard equipment adopted by the North and West Side companies for their trolley cars has been found to be well suited for these small locomotives, and it will be adopted therefore for them.

It will be seen by reference to the cut that these locomotives are by no means unsightly. They are about the same height as the ordinary car and about half as long. No passengers are permitted in the cab, and this gives the man in charge plenty of room to work and move about. In winter the cabs can be enclosed, as windows are provided, and this will make these cars much more pleasant to work upon than the open trolley cars or the grip cars.

MOTOR CARS FOR CHICAGO'S NORTH SIDE LOOP LINES.—VIEW OF MOTOR CAR AND TRAILER.

## Chicago Board of Trade Plant.

Contracts have been awarded for the complete reconstruction of the electric and elevator plant of the Board of Trade building, Chicago. The hydraulic elevators will be replaced by four Sprague high-speed electric elevators, the first to be put into service in Chicago. Sixty 1,600 ampere-hour storage battery cells of the Pumpelly-Sorley type will be installed to work in conjunction with the elevator and lighting service. There will be two Ames automatic tandem compound engines of 125 horse power each, which will be directly connected to Westinghouse 75 kilowatt 125 volt dynamos. Steam will be supplied by five horizontal tubular boilers set in Butman furnaces. The plant will include six 10 horse power electric motors for operating ventilating fans in different parts of the building. The switchboard will be of marble, and from it any motor or lighting circuit can be controlled. The building is being wired on a trunk system to provide for 100 amperes of current on each floor,

with a small feeder board in each room, so that tenants can have their office incandescent wiring done to suit their own requirements. Forty arc lamps will light the main rotunda, halls and settling room. B. J. Arnold is the consulting electrical engineer. The steam and electrical plants will be installed by John Mabbs, chief engineer of the Board of Trade, and J. W. Mabbs, electrician, respectively.

## Electrolytic Laboratory at Stolberg, Westphalia.

The Stolberg corporation for the extraction and metallurgy of zinc and lead has recently added to its works an installation for experimental electrolysis. Current is supplied by a dynamo which furnishes 60 amperes at 12 volts. Two accumulator batteries of three cells each are also em-

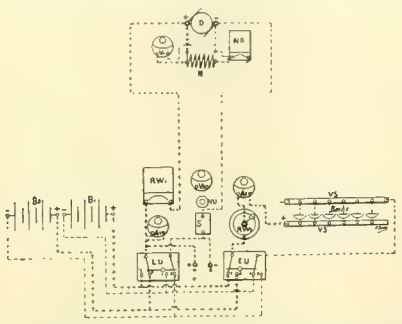


FIG. 1. ELECTROLYTIC LABORATORY AT STOLBERG, WESTPHALIA.—PLAN OF THE INSTALLATION.

ployed. The maximum of these batteries is 25.2 amperes, and maximum capacity 252 ampere hours. The object in dividing the cells into two groups of three each is to more readily effect the analysis of metals, such as nickel, cobalt and iron.

Three separate sources of current are thus available, two of which may be in constant use. Several conditions are possible, three of the most important being:

First—The use of the current direct from the dynamos.

Second—The charging of one battery by the dynamo while the second is being discharged.

Third—The dynamo current in use direct while one or the other of the batteries is being charged and the second discharged.

In order to readily manipulate these and other changes which are possible with the three separate systems, a considerable amount of switchboard combination is necessary.

Fig. 1 shows the route of the current from the dynamo $D$, which has its rheostat $N\,R$, and the voltage of which may be determined by the readings of the voltmeter $V_1$ and thence to the switchboard, Fig. 2. Crossing the rheostat $R\,W_1$ and the ammeter $A_1$, the current arrives at the terminals $a$ and $b$. Thence it is connected either by cables to the baths, or through the charging commutator $L\,U$ to one of the batteries, $B_1\,B_2$, while the other battery is furnishing current to the baths after this has passed through the discharge commutator $E\,U$, the resistance $R\,W_2$ and the ammeter $A_2$; finally a third combination permits of leading current into one of the batteries and to the baths at the same time. In this case the commutators of charge and discharge should have their switches closed upon the same contact. The other combinations are easy to trace.

In addition to the instruments already mentioned there is an automatic cut-out on the board, marked $S$, a voltmeter $V_2$, on which last may be read by the aid of a revolving switch, $V\,U$, the potential differences: First, at the terminals of the dynamo; second, at the poles of batteries *1* and *2*, and third, at the switchboard contacts $a$ and $b$.

In order to maintain a constant potential in all the apparatus, the current is all taken from the same bus-bars, which, to prevent error, are marked red for the negative and white for the positive poles. All the measuring apparatus and the switches, with the exception of the rheostat and voltmeter of the dynamo, are placed on the oak board, Figs. 2 and 3, and are protected by glass. Below are the bus-bars, which are above the experimental table. There are shelves where the experimenter, after the tests have been accomplished, can decant the precipitates without interrupting the current, by means of a siphon, which empties the vessels to a lower level where the fluid is caught in a receiving vessel, while at the same time the precipitate may be washed with water from a faucet. The accumulators are placed beneath a ventilating hood, which carries off the noxious gas.

A curious accident occurred in Houston, Tex., the other day. An express train was passing the corner of Liberty avenue and Carr street when an overhead trolley wire broke and fell on the steam whistle, tearing it to pieces, stopping the train, allowing the steam to escape and disabling the engine. It took an hour and thirty minutes before the street car company had the trolley repaired and the train could proceed northward pulled by another engine.

## Long-distance Transmission at 10,000 Volts.[1]

By George Herbert Winslow.

The Pomona plant was installed in the summer and fall of 1892 for the San Antonio Light & Power company of Pomona, Cal. It was increased in the following spring, and early last year the capacity of the plant was doubled by duplicating the entire equipment. At the present time, when the plant has been in regular operation for more than two years, and its complete success has established confidence in the successful outcome of many similar projects of greater magnitude, it seems fitting to present a careful description of the entire installation. The electric plant was installed under the personal direction of the writer, as electrical engineer, who presents many of his personal observations on its construction and operation.

The plant is used to transmit energy from a waterfall to sub-stations at Pomona, 13¾ miles distant, and San Bernardino, 28¾ miles distant, from which points it is distributed for incandescent and arc lighting. It consists of a Pelton water power plant and a Westinghouse alternating current transmission plant, in which generators supply currents to sets of raising and lowering transformers operating at 10,000 volts, and delivering current to the local circuits at 1,000 volts.

The water power for this plant is derived from the San Antonio creek, which is chiefly supplied by the melting snows and the rains on San Antonio mountain. Side canyons, however, also furnish some water. The creek flow for several miles through a narrow valley at the upper end of the San Antonio canyon in a bed which it has washed for itself in the layer of boulders and gravel formed by the action of an immensely larger stream in past ages.

At the lower end of the valley a sharp ridge extends eastward from the side of a neighboring mountain, from which it originally split off, and blocks up the valley except at a narrow place at which bedrock is exposed and through which the stream plunges suddenly downward at least 90 feet between precipitous walls of rock, forming the San Antonio Falls.

To utilize this fall, part of the water is diverted by a dam about 200 feet above the falls into a canal which conducts the water to a tunnel passing through the ridge. At the other end of this tunnel the water enters a large pipe leading to the power house, which is located 412 feet below the level of the outlet of the tunnel. A vertical projection of the pipe line, giving the sizes of the pipe, is shown in Fig. 1.

The pipe is of sheet steel, double-riveted throughout, and

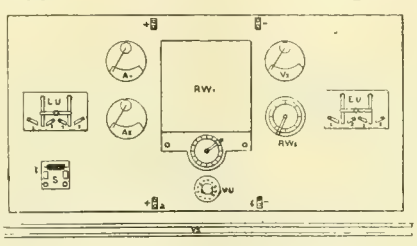


FIG. 2. ELECTROLYTIC LABORATORY AT STOLBERG, WESTPHALIA.—PLAN OF THE MAIN SWITCHBOARD.

was delivered on the ground in sections having a length of 11 feet six inches. These sections consist of four sheets, each three feet long.

The diameter of the pipe up to within 450 feet of the power house is 30 inches, with the exception of the length which connects it to the sand-box at the top of the pipe, which length is considerably expanded, so as to allow the water to flow slower on entering, and thus to reduce the entrainment of air. Near the power house a "reducer" is inserted in the pipe to reduce the diameter to 24 inches, and this size is maintained from this point to the power house. The pipe was designed to carry 2,000 miner's inches of water (measured under a head of six inches), without unnecessary loss by friction. The capacity is equivalent to 50 cubic feet per second, or 1,882 horse power at 390 feet effective head, assuming a wheel efficiency of 85 per cent. This is nearly three times the power for which the present station was built, but the extra capacity of 1,000 horse power obtained by increasing the capacity of the pipe costs so little when compared with the cost of building an entire new pipe line, that it is much more profitable to lay the larger pipe in the first place, if sufficient water can ultimately be developed to utilize the added capacity.

The thickness of the pipe is increased as it nears the power house to provide for the increase in pressure in the lower parts. At the first bend it is made greater than that of the sections above it on either side, because the pressure on it is greater. After passing the second air valve first No. 10 and then No. 8 steel is used, the latter size being continued to within a short distance of the power house. The last few lengths are of No. 6 steel.

The horizontal distance between the mouth of the tunnel and the power house is 1,940 feet, and the difference in level between the tunnel and the floor of the power house is 412 feet. The total length of the pipe, following the line, is 2,370 feet.

The sections of pipe, as received from the makers, were coated with asphalt, both inside and out, and parts of this coat were of course scraped off through rough handling. After the pipe was laid and jointed a man went through it and painted the joints with hot asphalt to prevent rusting.

In order to protect the pipe from the great changes in temperature which occur in the mountains between midday and midnight, earth and loose rock were placed around and on top of the pipe without any tamping, and where enough earth could not be conveniently obtained, brush was cut and piled on the pipe and covered with a light layer of earth and rock.

The lower end of the pipe is closed by means of a 24 inch Ludlow gate-valve, which is bolted to a cast-iron flange riveted to the end of the pipe.

The stem of the valve is geared to a small hand-wheel, partly on account of its weight, but chiefly in order that the gate may not be shut too quickly, as otherwise the pipe would be subjected to severe strains, resulting from suddenly checking the velocity of the column of water. For use under heavy pressures the gearing is also necessary in order to be able to move the valve at all. The head of water on this plant is so great that it is impossible to open the valve when the pipe is full, and, after closing the valve, it is necessary, before raising it, to partially empty the pipe by means of a relief-valve attached to the pipe close to the gate. The relief-valve is primarily designed to protect the pipe from shock by allowing the escape of a considerable quantity of water in case of an increase of pressure in the pipe; such, for example, as would occur should any obstruction partially close the opening of the gate. It has a circular valve so proportioned that a slight movement of it will afford a large opening for discharge. The valve is held in place by a weighted lever and is set so that a very slight increase above normal pressure will cause it to open.

The gate is connected by a tapering pipe of steel to a horizontal, cylindrical steel receiver 20 feet long and 42 inches inside diameter, from which the water is distributed to the wheels. The object of such a large receiver is to avoid the loss in head which would be occasioned by the eddies formed when drawing the water from the side of a smaller pipe. It also serves to keep air from being drawn into the discharge pipes in case it accumulates in the receiver.

Two tapering cast-iron pipes (a large and small one) are bolted to the lower side of the receiver at an angle of 30 degrees. These pipes conduct the water from the receiver to the under sides of two independent Pelton water wheels, which drive an alternating current generator and its exciter.

To the end of each pipe is attached a Ludlow gate-valve, the stem of which passes horizontally into the dynamo room through a bushing in the concrete wall. The larger of the two stems is geared to a hand-wheel; the other is fastened directly to a smaller hand-wheel. The flow from each pipe can thus be completely controlled from the dynamo room. The pipe running to the generator wheel is provided below its valve with two nozzles cast in one piece and attached to the valve by means of a limited ball-and-socket joint, which permits them to be moved vertically to deflect the water. This device is shown in Fig. 2.

The pipe supplying the exciter wheel has below its gate a throttle valve, the stem of which passes through the wall into the dynamo room, where it can be connected to a governor. The wheels are located directly below and in the plane of the receiver and above a raceway which conducts away the water after it drops from the wheels.

The speed of a Pelton wheel is dependent for a given load and head of water upon the amount of water striking the wheel, and therefore to maintain a constant speed this amount must be changed every time the load changes, and in proportion to the latter. In the case of the generator-wheel this change is produced by deflecting the water. Constant speed regulation may also be obtained by throttling the water, as is done in the case of the exciter-wheel. When the water is throttled there is loss in efficiency due partly to the scattering of the water as it flows from an aperture which it no longer completely fills (which causes much water to miss the buckets), and partly to the loss of head caused by friction in passing through the valve. With the deflecting nozzle there is no loss of efficiency due to this cause. There is, however, a great waste of water at light loads, since under a constant head the same quantity of water must be disposed of at all loads, and for light loads the greater part of it is wasted. To avoid this loss the use of a reservoir naturally suggests itself. It is an unfortunate fact, however, that high heads are confined to mountainous

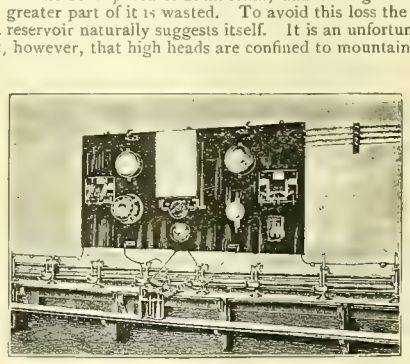


FIG. 3. ELECTROLYTIC LABORATORY AT STOLBERG, WESTPHALIA.—COMBINED SWITCHBOARD AND EXPERIMENTAL TABLE.

countries and that there a reservoir usually necessitates a high and consequently costly dam. The necessity of building a dam to withstand freshets so increases its cost as to make the use of a reservoir commercially impossible with high heads. Therefore, the water must continue to be wasted, and the chief apparent objection to deflecting nozzles is seen to be of no importance.

A set of tips of different diameters is supplied with each nozzle, so that the size of the jet used may correspond to the maximum load and thus unnecessary waste of water be avoided. The tips for the generator wheel range from 1½ to 2½ inches in diameter, while those for the exciter are from $\frac{7}{16}$ to ¾ inch. When tips are used of the proper size for the full load there is no need of throttling at the full load, and therefore no loss from this cause; and with the deflecting nozzle there is no waste of water at full load, so that for full load the two arrangements are equally good. This is not, however, the normal condition of operation of a lighting plant, for in such a plant each dynamo is driven by a separate wheel, and the load is constantly changing, so that

1. Read at the twelfth general meeting of the American Institute of Electrical Engineers, Niagara Falls, N. Y., June 27, 1895.

here the deflecting nozzle has the advantage. The deflecting nozzle is also to be preferred under high heads, to avoid the risk of straining the pipe by suddenly checking the flow of water, as would be necessary with a throttle valve if the entire load were suddenly thrown off.

Regulation by throttling is, therefore, only advisable in cases where the head is not excessive, and where the quantity of water obtainable is limited, as is the case where it has to be stored in and supplied from reservoirs, or when the supply is liable to sudden stoppage. The writer recalls instances of its value in cases which occurred while he was at Bodie, Cal., in the fall of 1893. There the water was conducted 4,700 feet in an open ditch to the pipe, and was delivered by the pipe under 350 feet head to drive an electric generator for a 12 mile synchronous power transmission. In cold weather anchor-ice would form and suddenly block up the ditch at some curve, and the water pressure would begin to fall slowly owing to the gradual emptying of the pipe, which could no longer be kept full by the diminished flow from the lower end of the ditch, which now acted as a reservoir. Having throttle valves in the nozzle, however, very little water was wasted, and the plant was thus kept running until the ditch was cleared, whereas with a deflecting nozzle the pipe would have been quickly emptied, even if the gate valves had been used as throttling valves (which is feasible if the load only varies slightly). Sometimes the head became so low that it was necessary to throw off part of the load and to run at reduced speed, to keep the motor in synchronism.

As already stated, the speed of the generating wheel is maintained constant for different loads by deflecting the stream. This is done by raising or lowering the deflecting nozzles from the dynamo room by means of a lever fixed to

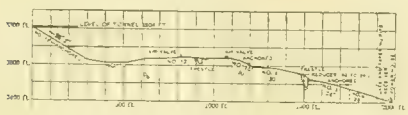


FIG. 1. LONG-DISTANCE TRANSMISSION AT 10,000 VOLTS. —PIPE LINE, FOMONA PLANT. HEAD 308 FEET.

a shaft which passes through the wall and carries a short lever connected to the nozzles by a link. The weight of the nozzles is counter-balanced by a movable weight on a horizontal lever-arm fixed to the shaft. The change of position of the nozzles is made automatically by the use of the Pelton differential governor. The ability of this governor to keep the generator at a practically constant speed depends on the governor being driven at a constant speed. I say practically constant, for there must be some change in speed before the governor can act, and then an appreciable time is required for this action to produce its effect. The constant driving speed in the present case is furnished by the exciter wheel shaft. The arrangement for governing is briefly as follows: The generator is geared to stop itself by turning the water off the wheel, and the source of constant speed is geared to speed up the generator by a contrary action. These two actions neutralize each other when the generator speed is the same as the fixed speed, but when either preponderates the difference acts. Thus an increase in generator speed will act to stop the generator, while a decrease, by making the fixed speed predominant, acts to speed up the generator. The governor consists, in part, of two similar miter-wheels which are mounted upon pulleys and placed face to face, loosely, upon a horizontal shaft, and are driven at equal speeds in opposite directions, one by the generator shaft, and the other by the exciter shaft. The speed of the pulleys is 200 revolutions per minute. In Fig. 3 it will be seen that between these wheels, and at right angles to the supporting shaft, there is fixed to the latter a cross-bar carrying two miter wheels, one at each end, which mesh with the two oppositely revolving miter wheels first mentioned. The result is that as long as the two outside wheels are revolving at the same speed the two central wheels will merely revolve upon their axes without tending to move in either direction the arms upon which they rotate. Now, if the generator speed increases, the corresponding side of each central wheel will have to travel faster forward than the other side travels backward, and the difference between these two movements will result in a movement of the central wheels in the direction of a faster wheel, and the cross-bar will consequently move the same way. The shaft to which the cross-bar is attached will, of course, turn with it, and as this carries a pinion meshing in a toothed quadrant connected to the lever which controls the nozzles, the stream will be pulled away from the wheel until the generator speed falls to its normal value. This point is quickly reached with a full load, owing to the drag of the load, but for a light load the inertia of the armature and wheel prevent them from responding so readily, and so makes the governor act longer than it should. Consequently the generator is not only brought to its proper speed but is carried past it, which causes the governor to reverse, and sets up a regular see-sawing in the speed. This see-sawing is increased by a certain amount of lost motion which exists in the governor and its connections, and by the action due to the fact that for a full head and light load the jets only impinge slightly on the buckets, and since the jets are round and their upper edges alone strike the buckets (which are themselves curved in the opposite direction) a slight movement of the governor produces a much greater change in the speed of the wheel under light loads than when the whole of each jet is in use. This effect of the jets is more marked when the governor is working to cut down the speed than when it is increasing the speed, because withdrawing the jets a given distance causes a greater change in the quantity of water striking the buckets than would be caused by advancing the jets an equal distance. The see-sawing will be further increased if the nozzles are not fully counter-balanced, as they would then tend to fall away from the wheel.

In order to avoid see-sawing it is the practice in this plant to reduce the head every morning during the light load. This is readily done by opening the extra four-inch relief valve and allowing water to escape until the pressure has gone down to that corresponding to the desired head. The valve is then set tentatively until the pressure remains about constant, when the final adjustment is made by partly closing the valve on the generator wheel pipe. Meanwhile, the governor throws more and more of the stream onto the wheel to compensate for the decrease in head, and the see-sawing stops. Where a deflecting double nozzle is used it would seem advisable to have in the upper branch a throttle valve so connected to the deflecting levers that when running under light load the valve would be entirely closed and the regulation be attained by deflecting the open nozzle. When the whole stream of this nozzle had come into use and more water was required, the valve would be opened. In this way the water would be used during light load under more favorable conditions than obtain with a simple deflecting nozzle, see-sawing would be avoided, and in case the supply of water became less, either suddenly, as by a sharp freeze, or gradually, because of diminished rainfall, the water would be used most economically and efficiently during the time of maximum load, which is the critical time. The effect of such an arrangement of the nozzles and valves would be to increase the capacity of the plant for a given minimum water supply, the period of minimum supply being precisely that in which all possible economies are of value. It may be objected that tips of such size should be used as would bring both streams into full use during maximum load, and that then no valves would be required, but against this is the fact that the maximum load (particularly in a lighting plant) does not reach the same value every night and that it is, therefore, always necessary to use tips large enough to meet the possible demand of any night.

In order to avoid breaking the teeth of the quadrant in case the governor should continue to act after it has moved the nozzles to either their highest or their lowest point, the pinion on the governor shaft is mounted loosely between two laterally movable toothed rachets which normally hold it in a fixed position, but either of which will be automatically disengaged by an adjustable lug on the corresponding side and end of the quadrant when the latter reaches either of its extreme positions, and will thus allow the pinion to stop, though the shaft continues to turn. Both ratchets may be instantly disengaged by hand and the position of the nozzles be regulated by a hand-lever when starting up, or in case of accident to belts or of decrease in head of water.

To start the plant the governor ratchets are first disengaged and the exciter is brought to a moderate speed; the generator is then started and its field is charged; it is then brought to about three-fourths of its full speed, and the speed of the exciter is then slowly increased until the cross-bar on the governor ceases to move. At this moment the ratchets are thrown in, and the governor takes charge of the generator speed. The speed of the exciter is now slowly increased to its full value, which of course brings the generator to full speed.

The speed of the exciter wheel is regulated by a small throttle valve, the changes in the position of which do not have any noticeable effect on the pressure in the pipe, owing to the small size of the jet controlled. This valve is so made as to have an equal pressure on each side of its axis when partly open, and hence can be moved from one position to another with little effort, which makes it of special value for use with automatic governors. When tightly closed, however, the areas subjected to pressure are no longer equal, and the valve sticks tightly. To obviate this the edges of

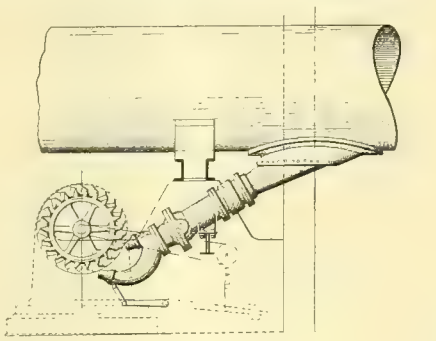


FIG. 2. LONG-DISTANCE TRANSMISSION AT 10,000 VOLTS. —PELTON WATER WHEEL WITH DEFLECTING NOZZLE.

the valve are battered slightly, so as to prevent it being completely closed.

An effort was made to automatically govern the exciter by means of a ball governor driven by a belt from the exciter wheel shaft and actuating the valve by means of two leather friction cones acting alternately on a beveled disk geared to the valve, but this proved unsatisfactory and was finally discarded, chiefly on account of the difficulty of maintaining the proper adjustment, by reason of the wearing away of the cones and of their swelling from dampness. The exciter was therefore controlled directly by hand for a long time. At present the valve is worked from a distance by a simple electrical arrangement devised by Mr. Imlay, in which advantage is taken of the fact that when the exciter is at full speed the movements of the valve necessary to regulate the speed are small.

The device consists essentially of two fixed solenoids in series, energized by current from the exciter and normally acting with equal force on two iron cores supported respectively at the opposite ends of a walking beam connected by levers to the valve, their normal function being to keep the valve stationary. Either of the coils may be short-circuited at will by means of a relay controlled by two keys and likewise actuated by current from the exciter. When either coil is short-circuited it ceases to hold its core, and the core on the other end of the walking-beam is pulled down by its own coil, thereby turning the valve in a corresponding direction. In order that this movement may not be too rapid the coils and cores are immersed in oil, which causes the coils to act as dash-pots to the cores; by this means the movement of the valve may be made as slight as is desired.

The relay is not really necessary, but was used to break the circuit in experiments made before the plan of short-circuiting one coil was devised, and has been retained because very convenient. A momentary closing of either key suffices to correct any change of speed, such changes being indicated by the compensating voltmeter. The current in the coils is reduced by a resistance in series with them about equal to that of one coil, and the current for the relay is shunted from the resistance at about two volts. The current normally passing through the coils and resistance is about two amperes at 100 volts (about one-fourth horse power), and when one coil is short-circuited the current in the other increases to three amperes, so that the maximum power used is two-fifths horse power.

The power house is 66 feet long by 30 feet wide, and has walls 12½ feet high. The walls, which are of concrete, were all built by tamping concrete in a space between temporary wooden walls forming a mould, a few feet of wall being built at a time, and the planks then loosened and raised to the height of the next section, the walls being thus made at the least expense for timber. The best English Portland cement was used. The walls were consolidated and cement saved by the use of well-washed fragments of

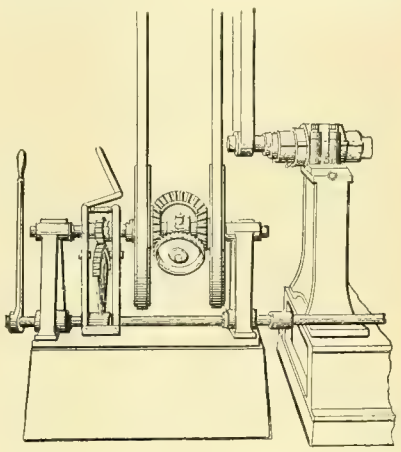


FIG. 3. LONG-DISTANCE TRANSMISSION AT 10,000 VOLTS. —WATER WHEEL GOVERNOR.

rock imbedded in the concrete. In order to obtain the greatest available fall the power house was placed as far as possible below the level of the fall. This necessitated blasting into the side of the hill so far that the entire wall next the hill was below the level of the adjoining rock.

The station was built to accommodate four 120 kilowatt, 7,200 alternation, 12 pole, single-phase Westinghouse alternators, with their full complements of raising transformers and switchboard apparatus, and two exciters. The first installation consisted of one generator with one 90 ampere 125 volt "I" exciter, capable of exciting the four alternators, and of 126 kilowatts capacity of oil transformers in 21 units of six kilowatts, one of these units being kept as a reserve.

Several different methods of connecting the raising and lowering transformers were given careful consideration, the test of actual use favoring a series connection for both primary and secondary coils of both sets of transformers, a plan which has proved to be thoroughly reliable in its practical operation at the Westinghouse plant at Portland, Oregon. It was, however, decided, in order to be able to change the initial pressure on the line in case of accident to any of the transformers, to connect the primary coils of the raising transformers in multiple to the dynamo, put the line coils all in series with the line and with a similar set of coils in the lowering transformers, and connect the other coils of the latter in multiple to the distributing circuits.

The next question was what size of transformers should be used. Many small transformers meant less cost per unit for repairs, greater facility of handling, and greater flexibility in case it were desired to change the voltage on the line. Their use, however, also meant greater first cost, more complication, and somewhat lower efficiency, but these points were outweighed by the former, and a transformer unit of six kilowatts was chosen. Each transformer is contained in a cast-iron box provided with vertical outside ribs, which serve to stiffen it, and also to cool the oil with which the box is filled, and which entirely covers the transformer. The box is covered by a cast-iron lid, which has conducting and radiating ribs both outside and in, the inner ones dipping into the oil at its hottest part and helping to cool it. The oil when heated rises through open spaces around the coils and spreads out in all directions, guided by the ribs on the lids, and sinks slowly down between the core and the sides of the box, thus having ample opportunity to become cooled. Each box is provided with a pet-cock, at the bottom, by which to draw off the bottom layer or oil, should it become too thick for evaporation. It also has an oil gauge to show whether the tops of the coils are completely covered without having to raise the lid. The boxes are supported upon a substantial timber frame, upon the top of which two iron bands serve incidentally to protect the wood, but chiefly to metallically connect the boxes to each other and to the earth, in order to dissipate the static charge received by the boxes, which is very unpleasant. The core of the transformer is connected to the box by a copper strip fastened around a block of wood upon which the core rests in the box, and to provide against the danger which would result from accidental connection between the primary and secondary coils, an insulated sheet of copper is placed between the latter and close to the dynamo coil, and is connected to the core by a tongue which is stuck between the plates.

The line-coil, of No. 7 B. & S. gauge wire, is inside the

dynamo coil, and is kept everywhere at a distance of one-half inch from latter, the ground plate and the core by walnut blocks boiled in paraffine, between which ample openings are left for circulation of the oil. The ratio of transformation is 1,000 to 450, so that in a bank of 20 transformers the dynamo pressure required for 10,000 volts and on open circuit is 1,110 volts, and on full load about three per cent. more than this, or 1,140 volts. The space between the 1,000 volt coil and the core is one-eighth of an inch. The terminals of the line-coils are brought up through the oil in mica-fiber tubes passing through heavy glass bushings held in paraffined wooden blocks which are attached to the sides of the boxes. The 1,000 volt terminals are similarly supported, but without glass bushings. The transformers are all connected in multiple to the dynamo circuit, which is supported directly above them on a light pine framework, which also supports the fuse blocks. The latter are single-pole, and the fuse passes through a hole in a marble block, the object of so confining the arc being to blow it out by its own force. Only one fuse is used on each transformer. The secondary or line coils are all connected in series by U-shaped insulated wire connections, which may be readily detached when making periodical tests for insulation of terminals, and which are entirely independent of the framework supporting the dynamo circuit. Accidental contact with the exposed connectors is prevented by the framework above mentioned, and there is an inflexible rule that the high tension side of the transformers shall not be touched under any circumstances whatever while the dynamo is running.

Clark's insulation is used on all wires connected to the transformers and to the dynamo, and the terminal wires of the full bank, which must often be disconnected for testing, are further insulated by heavy glass tubes at points where they might come in contact with other wires. All other transformer wires are supported upon double petticoat glass insulators, and all dynamo wires upon porcelain knobs.

The switchboard is of narrow redwood boards, tongued, grooved and beaded, nailed on a framework of yellow pine, the latter supported on porcelain insulators to keep it dry. The switchboard outfit for the one generator and one exciter consists of two 120 ampere fuse blocks, a field rheostat with a 25 ampere double-pole field switch, with fuses, one 150 ampere ammeter and a 200 ampere double-pole jaw-switch. From this switch the current passes to two four-dynamo, marble switch-panels which are connected in multiple to the dynamo, and are each provided with two pairs of contact plugs. By means of these panels and of the two 200 ampere dynamo-changing switches below them, any feeder can be operated from any dynamo which is connected to the switch-panels. Between each panel and its switch is a pair of 65 ampere Wurts shunt-wire fuse-blocks, each provided with an extra fuse and shunt which can be connected by inserting a plug should it be desired to double the fuses during the run, on account of overload or of weakness in the fuse. The remaining instruments on each feeder are a voltmeter, a No. 1 switchboard converter and a 150 ampere type "E" compensator. When both feeders were run from one alternator, one voltmeter was connected to the generator and the other to the feeder, and in this way the amount of compensation could be watched.

The oil transformers were tested before shipment with

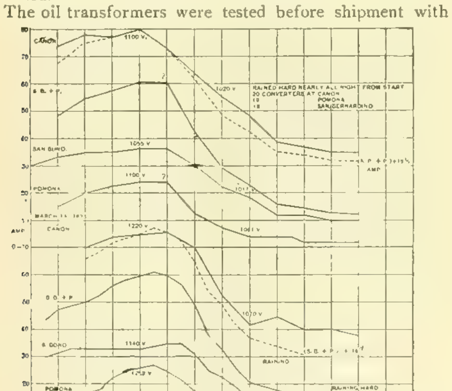


Fig. 6—Ampere Curves Showing Excess of Canon Load and also Decrease in Difference between Canon Load and the sum of Pomona and San Bernardino Loads as the Canon Load Increases.

Note increase due to rain. Raining in afternoon and nearly all night at Pomona. Snowing throughout canon and a mile or so outside of mouth of canon. 8 inches of snow at power-house, covering insulators and cross-arms completely. 1 inch of snow on wires. Snow damp and clinging. No wind. 21 conductors at Canon. 19 at Pomona and San Bernardino. 12 P. M.

FIG. 6. LONG-DISTANCE TRANSMISSION PLANT AT 10,000 VOLTS.

20,000 volts between the line-coil and the core and were then taken out of the oil and boxed. In order to expel any moisture which might have been absorbed by the insulation of the coils or have condensed on the cores during their long journey, the transformers were connected in two banks of 10 each, the line-coils of each set being connected in series to the generator, which was run at a reduced speed, and the secondary coils each short-circuited on itself. The coils were thus gradually heated to a point somewhat above the boiling point of water, which at that elevation was about 201 degrees F. They were kept at this temperature for a short time and then paraffine oil of a special grade ("Diamond") was poured slowly into the boxes at the edges so that the coils would begin to absorb oil at their lower ends, and thus drive upward the air and volatile gases occluded by the insulation. The transformers were then again brought to their former temperature, which caused expansion and partial expulsion of the air remaining in the insulation. Some of the air would, however, collect under the insulation at the top of the coils, and had to be freed by mechanical agitation, produced by stirring the folds of insulation or by pounding on the boxes. The heat caused volatization of some of the lighter elements of the oil, these coming to the surface as bubbles, just as the air did at first, and the agitation was kept up at intervals until bubbles from this cause also were entirely eliminated.

The 20 transformers, then connected as they would be when in regular use, and the two terminals of the line-coils, which were to give 10,000 volts, were connected in series with one hundred 100 volt lamps, which were then brought to full candle power, showing that the transformers were all in good condition. A similar test was then made at Pomona at the end of the 14 mile transmission line running to that place, after which the transformers there were prepared for work in the same way as at the power house, except that the grouping and initial voltage were changed.

There are two transmission lines, one 13¾ miles long, which supplies Pomona, and another 28¾ miles long, which supplies San Bernardino. Each line consists of two No. 7 B. & S. gauge wires. The joints in the wire are made with McIntire connectors. To further improve the joints the ends of the wires were bent back side by side and soldered together. After the Pomona line was com-

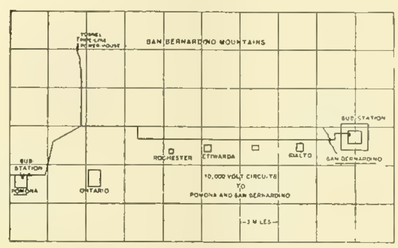



FIG. 4. LONG-DISTANCE TRANSMISSION PLANT AT 10,000 VOLTS.—ROUTE OF LINES.

pleted and the first 10 miles of the San Bernardino line was put up, the supply of connectors ran out, and the regular telegraph joint was substituted. The conductivity was assured by soldering as before. See Fig. 4.

The wires are supported upon large double-petticoat flint-glass insulators designed for this plant. These insulators are of perfectly clear flint-glass, which gives a better surface-insulation than is attainable with any other kind of glass.

It was at first proposed to use oil-insulators. The reason they were not used was because the glass companies which had undertaken to furnish them found on trial that they could not make them without considerable experimenting, which would have delayed the installation of the plant. This was no doubt fortunate, as the country through which the line passes is subjected to hot, dry winds which not only blow dust onto the insulators, but also inside them, and during the day the sun beats on the insulators until they become so hot that they nearly blister one's hands. If oil were used under these conditions it would soon evaporate and thicken, and become filled with dust. It would therefore seem undesirable to have used oil insulators in this case, or to use them in any other until an increased voltage makes them necessary, and the transmission of greater amounts of energy over the circuits justifies the additional expense necessary to keep the insulators in good condition.

The inside pair of pins was used for the circuit to Pomona and the outside pair for that to San Bernardino, until after the acceptance of the plant, but in anticipation of the installation of another generator the Pomona circuit was changed to the right-hand pair of pins, and the San Bernardino circuit to the left-hand pair, to avoid the fluctuation in lights which would result from inductive interference between two independent circuits.

Commercial lighting in Pomona was begun November 28, 1892, and a telegraphic order was at once sent for another set of reducing transformers, to be used at San Bernardino, where the local circuits were already nearly completed. It was a condition of the franchise for the latter place that lighting should be begun before January 1st, and work was pushed rapidly on the transmission line, over 28 miles long, until it was finished. The order for transformers had, however, been given too late for them to be delivered in time, and it was decided to reduce the pressure at Pomona to 5,000 volts and to take to San Bernardino the half of the Pomona bank thus made available. In order to avoid the re-heating which would have been required had the transformers been dismounted for shipment, the latter were hauled to San Bernardino on wagons without springs, after the lids had been packed so that the oil could not splash out. The transformers reached their destination after midnight, and the next day, December 31st, they were connected to the transmission line for a few moments to see that the latter was all right, after which all the lights on the circuit were thrown on for the night.

When the new transformers arrived they were set up and heated in the same way as the others. The heating was continued night and day until complete, without interrupting the regular lighting service. The change of both circuits to 10,000 volts was made February 16, 1893.

The sub-stations at Pomona and San Bernardino are small brick buildings, one story high, with flat tin roofs and numerous windows. The Pomona building contains two rooms connected by a door near the switchboard. The front room is used as the office of the company, and the other as a transformer room. The 10,000 volt circuit enters over the door, and is connected directly to the bank of lowering transformers, no switches or other appliances being used on the high tension lines either there or at San Bernardino. The switchboard appliances are a Stillwell regulator, two 100 ampère marble fuse-blocks, with double plugs and fuses, 100 ampere jaw-switch, 150 ampere ammeter, compensating voltmeter, compensator and converter.

The San Bernardino sub-station is longer than that at Pomona, and is not divided by a wall. The transformers are placed in a row along a side wall, and along part of the end wall next the switchboard. The transformers near the switchboard heat the most. This is probably due to the slight drop in wiring between them and the more distant converters. During the first year of operation a little new oil was put into the converters about every four months to make up for that evaporated, but none of the old oil was drawn off. The switchboard apparatus is like that at Pomona.

The Stillwell regulator has long been recognized as a valuable adjunct to the central station operating a number of feeders of different lengths from a single dynamo. Its utility is still greater in a system of long-distance transmission in which the transmission circuits are supplied from one dynamo, as was the case in this plant during its first year of operation, since it is not practicable to install such a system so as to operate with small line loss, and therefore means must be provided to compensate for the large differences in the pressure at the ends of the lines. The use of regulators at the power house was impossible when but one bank of raising transformers was used for the two circuits. Even when it became possible by the use of separate banks of transformers, it was still undesirable because the attendants at the power house would often have had to work both the regulators at once to properly compensate for changes in load, and their attention would be required by the regulators at exactly the time they should be free to attend to the generators and water wheels. A regulator was therefore placed at each sub-station, as already stated. These are each of 2,000 lights capacity and have a range of 10 per cent. up and 10 per cent. down. This variation of 10 per cent. (100 volts) is divided into 14 equal parts, so that each step corresponds to 7.1 volts. The diagram, Fig. 5, is taken from the station records for Sunday, January 22, 1893, and shows the number of changes required during the evening at each station. The line marked "off" is the base line; and the divisions above and below correspond to the steps on the dial and show to what an extent the regulators were used to increase or decrease the pressure. This diagram shows how impossible it would be to furnish lights without using regulators, even on Sunday, when the load is much smaller than on other days.

The distribution from both sub-stations is effected in the usual manner at 1,000 volts for incandescent lighting, the only point of interest being that a considerable number of Helios arc lamps are successfully used on the circuits.

While in use the transformers in the sub-stations give forth a continuous hum which depends for its tone on the number of alternations. This is an excellent indicator for the attendant, whose attention is instantly called to any change in the running conditions of the plant by the resulting change of tone. Its indications not only mark changes which are taking place and which can be detected on the voltmeter, but also give notice of coming changes before there is any other indication of them. It is thus possible to foretell a coming drop in voltage in time to use the regulator and thus keep the voltmeter needle perfectly still, though the voltmeter is a very sensitive instrument, and the regulator is often moved four or five notches. The hum often changes, however, without any corresponding movement of the voltmeter, but the sound is then somewhat different. At rare intervals the switchboard lights will suddenly change slightly in candle power before any change is noticeable on the voltmeter.

It is noticeable that the needle will often stand for a time perfectly still on the center, and, on a slight rise in the hum, will start gently rising, never more than three-quarters of an inch, and then, as the tone gradually becomes lower, slowly fall back to the center and stop without passing it. At other times the variation in hum is more sudden and the needle will rise and oscillate above the center. Again, the

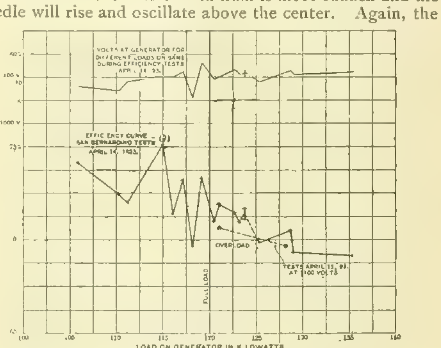


FIG 7. LONG-DISTANCE TRANSMISSION PLANT AT 10,000 VOLTS.

needle will oscillate equally about the center during a regular rise and fall of hum, its movement being apparently due to one impulse and not seeming to be modified by subsequent variations. There is no apparent change in candle power of the lamps during the voltmeter changes noted. These notes were made while the plant was running at only 5,000 volts, but they were later confirmed when using 10,000 volts. During dry weather there is considerable intermittent oscillation of the voltmeter-needle without there being any change in load or any other apparent cause, while in wet weather the needle remains perfectly still for many minutes at a time, often for as much as half an hour. A possible explanation of this oscillation may be found in the presence of static charges on the line, due to atmospheric electricity. That the line is often heavily charged from the air is shown by a number of observations. One afternoon a painful shock was obtained on touching the line at the cañon end, drifting clouds and a strong wind being noticed in the valley. Again, while using the telephone a report was heard in it so sharp as to cause momentary deafness. Later, after a moderate wind had been blowing for some time, loud reports were noticed on the telephone at long intervals. As the wind became higher the reports came oftener and the intervals between the reports became shorter. It was evident that there was a discharge from the lines through the telephone (which was on a metallic circuit) and that it depended on the rate at which the wind blew. In order to get the strongest effect the two wires were connected in the usual way to the raising and lowering

transformers, and one side of the telephone connected to one wire. On connecting the other side of the telephone to ground a sharp report was heard, and on maintaining the connection there was a sound as of steam escaping at a distance, with intermittent and very faint crackling. If the ground contact was made slowly there was a bright spark before the metals touched, and a loud report. If the fingers were interposed a smart shock was received. By making and breaking the ground connection rapidly, the line was prevented from accumulating a heavy charge, and no spark was visible, though a faint crack was heard. If a slight space was left between the telephone wire and the ground, a spark occurred at fairly regular intervals, and when the space was lessened the sparks become smaller and more frequent. When the wind lessened the sparks and reports became almost imperceptible, but on the wind becoming strong and blustery a large spark was again obtained. When one line-wire was di-connected from the transformers at Pomona the effect obtained from grounding that wire was less, owing to the reduction in capacity.

These observations, which were made on the Pomona circuit during hot, dry and cloudless weather, show conclusively that the lines were heavily charged by the action of the wind. The wind no doubt blows electrified air and dust against the wires, the latter thereby accumulating a static charge with a rapidity which we have seen depended on the speed of the wind.

Some curious conditions met with in the operation of the plant are shown in the ampere curves in Fig. 6, which were taken during very wet weather. Taking the maximum load measurements at 7 P. M. for March 14th and 8th, we note that the total apparent energy delivered by the sub-stations is 73 per cent. and 75 per cent. respectively of that delivered by the generator, while for a smaller load at 9 P. M. the respective percentages decrease to 47.6 per cent. and 48.6 per cent., in spite of the fact that the apparent energy delivered by the generator is in the latter case only half as great as in the former. These results are due to changes in the angle of lag caused by changing the load.

In the cañon curve of March 8th the load at 9:30 P. M. is seen to have increased considerably, although the sub-station loads were decreasing. This increase was due to the lamps were turned off the pressure became 10 times as great, or 140 volts. One generator brush was then raised, and the second leg of the circuit was connected to the first. On completing the circuit again there was a sudden flash on the armature, followed by a crackling noise and a brush discharge which lasted until the circuit was broken. The Pomona wires were then disconnected from the dynamo terminal, which was left free. With this arrangement faint sparks and a glow were noticed, as though the armature winding were grounded on the core, but a Wheatstone bridge test showed an insulation resistance of over 10 megohms. Since then the machine has been used regularly and has not broken down, so it is evident the spark must have resulted from a sudden increase of the potential of the armature winding above that of its core, which latter was permanently connected to earth.

This sudden increase may be explained as follows: On closing the circuit the condenser formed by the line and the earth began to discharge through the metallic circuit afforded by the armature and converter windings, but the inductance of this circuit checked the discharge so quickly as to produce an excessive pressure which could only be relieved by the discharge taking place through the insulation of the armature-winding to the grounded core, which is what happened.

A similar test was made on the San Bernardino wires in the previous January during dry weather, the only change being that the single lamp was not turned off. With only one wire connected, one 16 candle power lamp came nearly to candle power. On connecting the second wire to the first (at San Bernardino) the lamp burned at full candle power. Ten lamps (the full load) were then put on the converter and burned dimly. As they were turned off one by one, the others brightened until the last lamp lighted up as before. This test did not cause any discharge on the armature, in spite of the fact that the circuit was twice as long and the capacity thus twice as great. The probable explanation of this is that the inductive resistance of the converter was not so great as in the other case, on account of the single lamp being left burning. It is also possible that the breakdown in the other test was assisted by the presence of copper dust on the winding.

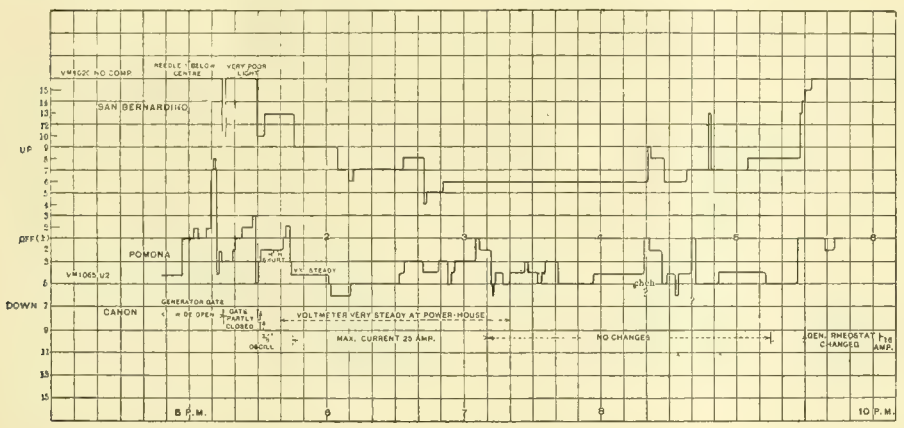



FIG. 5. LONG DISTANCE TRANSMISSION AT 10,000 VOLTS.—RECORD OF SUNDAY, JANUARY 22, 1893, FOR POMONA, SAN BERNARDINO AND CANON.

fact that the rain, which had previously ceased to fall at Pomona, began again.

The electrical resistance of the Pomona circuit is 74.9 ohms and that of San Bernardino 156.4 ohms at about 90 degrees F.

The insulation resistance of the circuits varies from far beyond the limits of an 11 megohm bridge in dry, hot summer weather to as low as 0.65 megohm during light rain. The latter value is that obtained with the two San Bernardino wires in series, and represents an insulation resistance per mile of over 37 megohms. On a clear, sunny day the insulation resistances of one Pomona wire and of one San Bernardino wire were respectively 11 megohms and 5½ megohms, which are in the exact relation which would be expected.

The lines cannot be tested for grounds or for continuity with a magneto bell, as their capacity is such that the bell will ring loudly when the wire is perfectly insulated and the circuit open. This capacity also prevents the use of the ordinary converter test for line leakage, as the lamp on the secondary will burn as though there were a ground even when the line is perfectly clear. By adding lamps, however, the light may be cut down until the last lamp added extinguishes them all. This would not occur if the light of the first lamp was due to a difference of potential on the primary caused by a ground, as then the added lamps would become as bright as the first. The primary current is thus seen to be limited, and to be due to the capacity of the line. If the proper number of lamps has been added to just secure darkness when the line is known to be free from grounds, the converter may be used to show grounds on that line, since the presence of a ground will cause all the lamps to brighten. The line test should only be made after ascertaining with one lamp that the generator is not grounded, as otherwise the leakage current for the greater number of lamps might burn the insulation of the generator. A very good example of Prof. Fleming's "condenser effect" was met with in the summer of 1893, while the engineer was trying this converter test for measuring line leakage. The primary of a 1,000—100 volt converter was connected between the ground and one terminal of the generator, the other terminal of the latter being connected to one wire of the Pomona circuit. The resulting secondary pressure was 30 volts, which made one lamp burn dimly. When 10 lamps were turned on, the pressure dropped to 14 volts. When all

A comparison of the San Bernardino switchboard voltmeter was made with a Weston instrument and gave important results.

First—With no load the San Bernardino instrument was about 14 volts (11.2 per cent.) low at 125 volts, while at 97 volts it was only 11.7 volts (12 per cent.) low.

Second—With a city load (inductive, consisting of lightly loaded converters) of 7½ amperes it was 11 volts low between 107 and 96 volts, while for 15 amperes it was only 8.5 volts low. Further increase in load caused further reduction in the difference, until for 40 amperes the instrument was only five volts low.

Third—With a tank load (non-inductive) of nine amperes it was only nine volts low at 99 volts, and as the load was increased the difference decreased until for 97 amperes the instrument read the same as the Weston.

It is evident from these observations that a voltmeter which consists essentially of a solenoid and a movable core is not the proper type of instrument for circuits such as those used in the present case, in which transmission circuits of great length are used in conjunction with transformers. The voltage at San Bernardino during the tests was therefore measured with a Weston portable voltmeter.

A comparison between the ammeters used at Pomona and San Bernardino showed that for readings above 67½ amperes the San Bernardino instrument read higher than the other. As there was no reason for considering one instrument more accurate than the other and no way of telling which was right, the San Bernardino readings taken during the test were reduced to the average of simultaneous readings on the two instruments.

A short test of the Pomona circuit was made on April 11th, the results of which are given in Table I.

A preliminary efficiency test on the San Bernardino circuit was made April 13, 1893, with the results shown in curve in Fig. 7. In this, as in all the other tests, a variable load was obtained by the use of a water resistance.

An efficiency test of the San Bernardino circuit lasting five hours, during which the generator was kept at full load or overload, was made April 14, 1893. Readings were taken every fifteen minutes, and the efficiencies and the corresponding voltages for different loads are plotted in Fig. 7. The most prominent feature of this efficiency curve is its irregularity. This is, however, satisfactorily explained by referring to the curve of generator voltage, on which it is seen that the high efficiencies correspond to high voltages, and vice-versa.

It will be noted that the apparent efficiencies shown by the preliminary test at San Bernardino agree very closely with the results of the long efficiency test there. On calculating the apparent efficiencies for different loads from data obtained by laboratory tests, and comparing them with the measured apparent efficiencies, it is found that they agree within 3 or 4 per cent. This very close agreement is exceedingly gratifying, particularly when we consider that the tests of the plant were made with ordinary commercial instruments, and that the laboratory tests were made about a year before the commercial tests.

An interesting and unique test was made May 2, 1893, by connecting the Pomona line wires in series with the San Bernardino circuit, and transmitting about 100 horse power to San Bernardino by way of Pomona. The length of the circuit was 85 miles, and the distance of transmission 42½ miles. This is the greatest distance yet covered by any transmission since the Frankfort experiments. The measurements are given in Table II. The apparent efficiencies are much lower than those indicated by calculations, as in the latter no account was taken of the capacity and inductance of the circuit. The voltage of the generator as measured is about 5 per cent. above that calculated, and the amperes measured notably exceed the amperes calculated. These results are attributable to the introduction of the Pomona loop, which added both capacity and inductance.

In order to reduce the cost of operation, the San Antonio company first dispensed with the sub-station attendant at Pomona after 11 P. M. This they did some time before the acceptance of the plant, after assuming the responsibility for any damage which might result. No trouble occurred, and, after the acceptance (May 6, 1893), the same plan was put in operation at San Bernardino. After working in this way for several months, the Pomona station was started in the afternoon and then locked up until the next morning. This arrangement was made possible by running the generator so that the lights should not be too high at Pomona, the lights at San Bernardino being kept right by the attendant with the Stillwell regulator.

In January, 1894, another 120 kilowatt generator was installed with an equal capacity of oil transformers, and the Pomona and San Bernardino circuits are now each operated from separate generators with separate banks of transformers of 10,000 volts. Since this change the San Bernardino attendant has also been dispensed with, and the bookkeeper starts up in the afternoon and then locks up the station for the night, as at Pomona. The voltage of the lamps on each circuit is regulated by the engineer at the power house, the generator pressure necessary at different loads to keep the lamps at the proper brilliancy being automatically indicated by the compensating voltmeter on each circuit. Thus after the plant is started, the engineer has sole charge.

TABLE I.—EFFICIENCY TESTS, APRIL 11, 1893, POMONA CIRCUIT.

| Canon (20 Converters). | | | Pomona (18 Converters). | | | |
|---|---|---|---|---|---|---|
| Amperes. | Volts. | K. W. | Amperes. | Volts. | K. W. | Efficiency per cent |
| 120 | 1,100 | 132 | 105 85 | 919 | 97 28 | 73 7 |
| 118 5 | 1 100 | 130.35 | 105 85 | 945 | 100 01 | 76 73 |
| 119 5 | 1,100 | 131 45 | 107 4 | 029 | 99 78 | 75 9 |

TABLE II.—142½ MILE TRANSMISSION TEST, MAY 2, 1893, CIRCUIT TO SAN BERNARDINO, BY WAY OF POMONA, 85 MILES.

| Canon (20 Converters). | | | San Bernardino (18 Converters). | | | |
|---|---|---|---|---|---|---|
| Amperes. | Volts. | K. W. | Amperes. | Volts. | K. W. | Efficiency per cent |
| 05 | 1,120 | 106 4 | 8 75 | 847 | 68 4 | 64 28 |
| 96 | 1,130 | 108 5 | 78 8 | 865 | 68.16 | 62 82 |
| 100 | 1,200 | 120 0 | 81 7 | 893 | 72.66 | 60 8 |

## Electrocution of Shade Trees.

[From the *Chicago Record*.

It is a question whether the stringing of electric wires in cities and villages will not destroy a large proportion of the shade trees. Complaint is made in several cities that where the wires pass through the foliage the trees in nearly every instance have died, presumably from the effects of the electric current. It has been noticed also that the death of the trees almost invariably follows a season of rain, when the wet leaves are good conductors of electricity and carry it from the wires to the trees. In some cases the death of trees has been caused by wires supposed to be thoroughly insulated, the covering having been rubbed off the wires by the friction of the branches when moved by the wind.

The evidence that the trees have been killed by electricity is furnished by the fact that in numberless instances the trees through which the wires pass died in an hour during a storm, while those standing a few feet from the wires were uninjured. These results will raise the question as to the liability of electric light companies for the damage caused by the killing of shade trees. The right to string electric wires does not give the further right to destroy the shade trees, which may constitute the chief value of a piece of real estate. Neither does it give the right to lop off the branches and otherwise disfigure ornamental trees simply because such branches happen to be in the way of the wires. This has been done by an electric light company in one of our suburban villages, and many large and beautiful trees have been practically ruined by such vandalism.

This destruction of trees is quite likely to lead to expensive litigatition before a property-owner's right to receive damages for his loss is established by the courts. A good deal of trouble could be avoided if electric lighting and power companies would take pains to place their poles and string their wires so as not to interfere with the ornamental trees along their lines.

A firm in Oldham, England, has on its sign the inscription, "Tailors, clothiers and electrical engineers."

Western Electrician

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CIRCULATION, 16,630.

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THE convention of Edison Illuminating companies at Detroit this week will no doubt prove a most interesting gathering for the men in attendance, although as far as the general trade is concerned the meeting is of no special importance. This is due entirely to the attitude of the organization, which has continued since its inception to hold secret meetings and suppress publication of all useful information that may be presented at these meetings. At the present time this policy is of course supremely ridiculous, but the association adheres to it and the rest of the world recognizes its right to conduct the business of the organization according to its own ideas. It keeps up the semblance of exclusiveness and that seems to satisfy the members.

AN admirable description of the construction and operation of the Pomona plant is presented elsewhere in the paper on "Long Distance Transmission at 10,000 Volts," by George Herbert Winslow, which was read at the recent Niagara Falls meeting of the American Institute of Electrical Engineers. The article is an interesting description of an important enterprise by one of the men under whose direction the work was successfully accomplished. The paper is confined strictly to the technical features of the undertaking. Its practical value might have been increased by the consideration of the commercial features of the enterprise, which, by the way, comprise the all important point at the present time.

AMONG the many noticeable improvements in general affairs that have been brought about by the extensive application of electricity to every-day commercial life is the effect it has had in broadening the views of people and their ways of doing business. It is not many years ago since the Chicago Board of Trade was engaged in a conflict with the telegraph companies. Members of the board were opposed to the presence of the companies' agents upon the floor; they sought to restrict operations rather than extend them, and the telegraph companies of course desired to furnish as much news to the outside world as possible. Now the members have changed, and they not only invite the co-operation of telegraph companies, but they have determined to take advantage of the telephone in local business, which for their purposes has many advantages, and it has been decided to allow the placing of telephone booths in the exchange, thus giving brokers the advantage of sending their orders to their representatives over the telephone instead of employing messengers. It is really a remarkable victory for the telephone.

ONCE more the gallant Col. Payne is beset by foes and called upon to defend himself against the attacks of rivals. This time the colonel's job is in danger. There is a movement on foot to have his appointment as receiver for the Milwaukee Street Railway company set aside. There are people in Milwaukee and elsewhere who refuse to accept the colonel's assurance that he is working for the good of the people whose money built and equipped the magnificent system of street railways in Wisconsin's beautiful metropolis. The reorganization of the company, as planned by the colonel and his associates, does not meet their approval any more than did his administration of the company's affairs before it was compelled to go into bankruptcy. In fact the complainants in this case view with suspicion every movement that has been made or is contemplated by the doughty colonel or his followers. They claim that the company has been "managed" to death and that those who were responsible for this result have found means for turning the defunct corporation to profit. Their objection to this last movement has become so pronounced that there is some reason to fear that Receiver Payne may find considerable difficulty in retaining possession of the remains.

CONSIDERABLE attention has been bestowed upon the subject of utilizing petroleum for fuel in electrical central stations, especially in large cities, where smoke is a nuisance, and in many places complete equipments of improved burners have been made. Many other large enterprises have adopted this system, and now it is feared that all the time and money expended in perfecting this apparatus have been thrown away. It is reported that the Illinois Steel company has abandoned the use of oil as a fuel for 35 boilers in its Bridgeport plant and now is firing with soft coal. The company named is not the only one which has recently changed from oil to coal after having used the oil as an acceptable substitute for coal. The reason is a considerable advance in the price of the kind of oil used for steam-making, owing to the reported falling off in the oil supply. It was expected some months ago that the decrease in production would mostly show itself in a smaller volume of exports, but the domestic consumption also is decreasing because of the higher prices demanded for the oil. It is even said that the oil refining works at Whiting, Ind., near Chicago, now use large quantities of coal, finding that more economical than to burn their own raw material for fuel. Several electrical plants in Chicago which have been using oil during the last few years are again using coal and others are making arrangements to go back to the old method.

AT last the American Bell Telephone company has unfolded its policy in regard to the Berliner patent. It will attempt to enforce this patent, and it has already begun proceeding in the United States Circuit Court at Boston to secure injunctions restraining infringement by anti-Bell companies. The papers are returnable September 3d, and both complainant and defendant express a desire to have the case pressed for trial, so that an early decision may be reached. It is needless to say that this desire is shared by the entire community. It is a matter of such great public importance that the courts would be justified in giving this case precedence over others if it were necessary, in order that there be no further delay in determining the exact status of the telephone question. The case will be followed with interest by the entire community, and it will receive careful attention at the hands of telephone men. It is quite probable that other companies will assist in the defense, although the association of eastern manufacturers in which the defendant is prominent, had not been perfected at the time the action was begun. Just what position the Telephone Protective Association of America will take has not yet been determined. Its attorneys have been instructed to carefully examine the case, and the association will no doubt be governed by the report that will be made as a result of this investigation. If a test case is to be made, it is to be hoped that the anti-Bell companies throughout the country, regardless of location or affiliation with the different associations, will co-operate in making the defense as strong as possible. The question may as well be settled now as at any time, and as the anti-Bell men in every part of the country profess confidence in their ability to overthrow the Berliner patent, there should be no hesitation about their taking an active part in the present suit.

IT is announced that the West Chicago Street Railroad company is planning to abandon the horse cars which are now run after midnight and in their place substitute electric cars. The company desires to improve the after-midnight service. It is purposed to shorten by half the time now made by horses. The same number of cars will be retained, and hence, as the distance will be made in half the time taken heretofore, late night and early morning travelers will have to wait only half the time they now do before they can board a street car. Owing to the fact that the trunk lines, such as the Madison street, Milwaukee avenue and Blue Island avenue, are cabled and do not have trolley poles and wires, new routes will be selected for some of the cars that run after midnight. It is proposed, for instance, to run the cars now traveling in Milwaukee avenue over Lake street to Milwaukee avenue, thence in that street to Halsted, north in Halsted to Chicago avenue, west in this street to Robey, and north in Robey to Milwaukee. Another feature of the plan is the proposition to extend the present electric lines. The Van Buren street line now runs from Western avenue to Halsted street, but poles have been erected and wires have been strung on that street from Halsted to Clinton street. It would take only a little longer extension to bring the line into the downtown district. The Harrison street electric line, which was put into operation last week, depends upon horses on only a small part of the way, namely from Adams street bridge to Michigan avenue. The route west of the Adams street bridge is in Adams street to Desplaines, south in Desplaines to Harrison, and west to Western avenue, The electric part of the Lake street line, which begins at Wabash avenue and ends at Halsted street, would, according to the plans, be extended west from Halsted street. These changes, which, by the way, are generally favored by the taxpayers of the district through which it is proposed to operate, will make an important addition to Chicago's already immense electric railway system.

ON another page in this issue is presented an article describing and illustrating the motor cars employed by the North Chicago Street Railroad company on several lines that are feeders for the cable trunk lines. There is nothing novel about the electrical equipment of these cars, interest in the application being due to the requirements of the service and the fact that the trolley was selected after several other forms of propulsion had been tried, only to be found impracticable and inapplicable on account of local conditions. The photograph from which the illustration is reproduced was taken at the corner of Belden avenue, on Halsted street, in front of the McCormick Seminary property. This is a part of the experimental loop line upon which Mr. Yerkes gave trials of oil and gas motors and after these had been discarded, put in an underground electric conduit system. A great deal of time was given to these experiments and much money was expended in investigating and developing the several systems. Experts were constantly employed upon the several types of motors tested and it was generally acknowledged that an honest effort had been made to find some practicable means of propulsion that would make the introduction of an overhead trolley system unnecessary. This subject occupied the attention of the engineering department of the company for nearly five years, almost to the exclusion of other matters, and finally Mr. Yerkes became convinced that he had exhausted the possibilities of other systems without finding one upon which he could depend, and accordingly he decided to introduce the trolley upon the cross-town and feeder lines. As a temporary arrangement he utilized a number of old Belgian motors or gas engines which had been discarded, These trucks were electrically equipped and placed in service and they proved very satisfactory. Some changes of minor importance were made, and the new motor cars proved to be just what had long been needed. Further trial showed them to be very satisfactory both in point of economy and efficiency, and they were put into service on other lines. In a short time they will be familiar objects upon many North and West Side lines. It is certainly gratifying to electric railway men, especially those whose interests are centered in the overhead trolley, to find Mr. Yerkes an ardent advocate of this system after devoting so many years and so much money upon experiments with other systems in the hope of finding one that would prove superior to it. The advocates of the much abused trolley can be excused for exulting over their victory, for it is certainly a notable achievement.

## Validity of the Berliner Patent to be Tested.

[illegible] has been declared by the American Bell Telephone Company upon outside concerns, and an attempt will be made to regain a monopoly of the business through the Berliner patent. On August 5th at Boston papers were served, in behalf of the American Bell Telephone company, upon the National Telephone Manufacturing company in a suit for an order to restrain the latter from infringing the Berliner patent. The suit will test the validity of the Berliner patent, and will be fought by the National company, with the assistance of several other corporations. A hearing is assigned before the United States Circuit Court for the first Tuesday in September. This is the first action brought under the Berliner patent by the Bell interests. The National company is not a member of the Telephone Protective association of America, but is one of the companies interested in the formation of the Eastern Telephone Protective association, and it is expected that its associates in that organization will assist in fighting the present case. It is promised that a strong defense will be made.

## Action of the Telephone Protective Association.

Although the National Telephone Manufacturing company, the defendant in the suit begun by the American Bell Telephone company under the Berliner patent, is not a member of the Telephone Protective association, the executive committee of that organization held a meeting at Cleveland last week for the purpose of considering the subject and taking steps to protect the interests of its members. It was determined to have the attorneys for the association examine the papers in the action, follow the proceedings closely and gather such information as might prove of value to the organization in case the Bell company should proceed against any of its members. President Keelyn after the meeting said that the members of the committee did not fear the outcome of the present action. The fact that a company not identified with the organization was selected for the test case was looked upon by the committee as an acknowledgment of the strength of the association's position, and was very gratifying to the organization.

## Advocates Fighting the Berliner Patent.

*To the Editor of the* WESTERN ELECTRICIAN:

In your article on dissensions among anti-Bell companies you quote from President Keelyn: "If any member of the association is making a device which infringes the valid claims of the Bell or other patents, the association will hardly consider it in duty bound to offer its protection. However, notwithstanding this, the association will render its aid to keep properly constructed telephone apparatus in the market for the public."

I wish to ask Mr. Keelyn and all others interested in the telephone business, if they believe it possible to make a contact battery transmitter that will not infringe the Berliner patent? I have read the specifications of Berliner carefully and many criticisms of them. I have also examined nearly every type of transmitter made and have come to the conclusion that it is impossible to get around this monster fraud, and that all who make, sell or use contact battery transmitters, outside of the Bell circle, are liable to them for damages as long as this '91 Berliner patent is valid. For the last eight years I have thought the time would come when telephones could be sold outright, and I have devoted a good portion of my time to the study of this valuable instrument and the patents protecting the Bell company in its use. The issuing of this last Berliner patent to that powerful company was the last straw, and I think we should join hand in hand and fight it. Drop all east and west or north and south divisions, acknowledge that there is but one thing in our way—the Berliner patent—and fight it to the bitter end. JAMES D. RANDALL.

Memphis, Tenn., July 29, 1895.

When Mr. Keelyn's attention was called to Mr. Randall's communication he made the following statement: "The Berliner patent does not cover all forms of battery telephones. The first Alexander Graham Bell patent showed a battery transmitter. This patent is acknowledged to have expired March 7, 1893. No adjudication has yet been had declaring the Berliner patent valid. An adjudication by Judge Carpenter indicated what another court would do in a case involving this patent upon its merits, therefore I thinks that the Berliner patent is not valid. Judge Carpenter adjudicated two questions upon this patent upon an extensive hearing, deciding against the Bell company upon both questions. The Court of Appeals simply used the technical point that Judge Carpenter should not have allowed the government to raise questions which it specifically stated could be raised by anyone else in another suit upon its merit. There are several other reasons why the Berliner patent is not valid to-day.

"Mr. Randall is very much in error and his opinion is contrary to that of the best patent attorneys in this country upon the Berliner patent. There seems no question that the Berliner patent would be defeated in litigation reasonably well conducted.

"Mr. Randall's suggestion [illegible] east and west or north and south division,' is a good one, and should be brought to the attention of a few jealous people.

"There is no doubt that the Western Telephone Construction company will continue to make high class battery telephones without any interference through the courts upon the Berliner patent."

## Convention of Edison Companies at Detroit.

Pursuing the same policy that has marked their history, the convention of the Edison companies at Detroit will probably be a very unsatisfactory meeting excepting to Edison men. It would appear that the policy of keeping everything under lock and key was to be followed more closely this year than heretofore. The announcement sent out by Secretary Barstow is dated July 26th, but was not given to the press until last week, and even then it did not contain any valuable information. Here is the notice:

The annual convention of the Association of Edison Illuminating Companies will be held at the Hotel Cadillac, Detroit, August 13th, 14th and 15th.

The first two days of the convention will be devoted to papers with discussions, together with any business which may come before the meeting. On the last day (August 15th) the delegates will be entertained by the Edison Illuminating company of Detroit and the General Electric company.

On account of the large number of short papers to be presented, the proceedings of the convention will be particularly interesting, and as many new companies have been admitted a large attendance is expected. All delegates intending to be present should notify C. P. Gilbert, secretary and manager of the Edison Illuminating company of Detroit, in order that he may arrange accommodations for them.

## Location of General Electric Factories.

There is a widespread belief in eastern electrical circles that some change is impending in the location of the factories of the General Electric company, either that all the plants are to be consolidated at Schenectady, or —and this is considered unlikely—that an entirely new site, such as in the vicinity of Niagara Falls, is to be selected. As will be seen from the following, which was written by the Lynn correspondent of the *Boston Traveler*, there is much apprehension in Lynn:

The rumor, which now is nearly an established fact, that the several plants of the General Electric company, situated in Lynn, Schenectady, N. Y., and Harrison, N. J., are to be consolidated at one given point, probably near Buffalo, N. Y., is causing a great deal of anxiety and agitation in this city, especially on the part of property owners and merchants in that part of Lynn which is contiguous to the several factories of the company.

The company in Lynn employs at the present time 2,700 hands, which is a decrease in its help of nearly 50 per cent. since the amalgamation of the Thomson-Houston Electric company into the General Electric company, and if the plants are taken out of Lynn it will throw a majority of this number of persons out of employment, since but a small percentage of this force can go to the new center.

Everyone interested in this move on the part of the company has been trying to get an affirmative or denial of this rumor, but none of the officials of the company see fit to give any information, simply saying that the time is not yet ripe to give anything to the public.

One stockholder, however, has leaked the fact that the company, by its stockholders, has for a month past been seriously considered the feasibility of maintaining its different factories in one city and thereby have one large establishment. The division of this company's factories, in the first place, was the outcome of a desire to satisfy two sets of stockholders, those of the Thomson-Houston and of the Edison Electric company. This having been worked for all it is worth, to show to the stockholders that they were wrong to think that it would prove more satisfactory to maintain the two factories separately, it has lately occurred to the minds of the stockholders that by consolidation a larger dividend will be paid. On account of this, it is said, the first step towards locating all the factories near Buffalo has been taken, and that already the company has a refusal of power from the Niagara Falls Power company, which can furnish 100,000 horse power.

This will be a hard blow to Lynn, and a *Traveler* man heard one of Lynn's largest capitalists say a few days ago that Lynn would have been a great deal better off if the electric plant had never been located here. When it was first started the people of Lynn, mostly those who had been for years thrifty and saving and were not overburdened with money, put their money into the shares of stock, with the result that many lost nearly, if not all, the money thus invested. Again, the large number of men employed by the company induced many real estate men to buy up land and build houses that would be within convenient walking distance of the establishment. The result of this has been only too apparent, and persons who were considered wealthy at that time are now poor.

Ever since the General Electric company got control of the Lynn establishment there has been a heap of petty jealousies between the Massachusetts stockholders and those of New York, the latter trying in every way possible to have all of the work done in Schenectady, while the Bay State end of the combine were equally determined to keep the plant in operation here. It now appears that both are on the compromise, and a third city gets the prize.

## Incandescent Lamp Test.

Prof. B. F. Thomas of the Ohio State University, Columbus, Ohio, has recently completed an interesting test of Packard incandescent lamps, for which some remarkable claims have been made as to maintenance of candle power, increase (instead of decrease) in the efficiency of the filament during burning, etc. The test was carefully conducted, as will be seen from Prof. Thomas' description:

"Weston instruments were used for the electric readings —a milliammeter reading to 0.001 ampere for current strengths and a voltmeter reading to 0.1 volt for voltages. These instruments were carefully compared with the university standards. For candle power readings a Sumner-Brodhun sighting box was adapted to an accurately graduated portable photometer bar, 100 inches long. The lamp under test was placed at one end of the bar, and a 100 volt 16 candle power lamp, which had been used some time, was placed at the other end, and used as a working standard. This lamp and three similar check lamps were first carefully measured on the university standard photometer, against a Harcourt pentane lamp, whose value was well known from many series of comparisons with the best sperm candles. During these tests the incandescent lamps were supplied with current from a good storage battery. Electric readings were taken with the Weston instruments named above.

"All photometer readings, here and at the station, were made by me. At least four settings were taken for each reading, and the sighting box was severed after each setting. Successive settings seldom differed by more than one per cent. The electric readings were taken by two experienced students, A. H. Jones and R. D. McCarter, Jr. One hundred lamps, labeled '16 candle power, 100 volts,' were obtained for this test. They were about equally divided into two lots, having distinguishing marks inside the bulbs. Twenty-five lamps were taken at random from each lot for test. In order that we might run the lamps at as nearly constant voltage as possible, wires were run to the test room from the station circuit, which is brought back from a junction box at the mains of the general lighting system of the company. The mains are kept at as nearly constant potential as possible by an attendant at the switchboard, who is guided by the readings of a Weston voltmeter attached to pressure wires from the mains. Unfortunately, at a point between the mains and the station, a motor was run from the station circuit which supplied us with current. The running of this motor caused momentary abnormal changes in voltage during the day, but at night it was not running, and our voltage was quite steady. If the lamp circuit had been run from the station switchboard, it would have been necessary to provide for constant watching and regulation of the lamp voltage. As already stated, the voltage was not perfectly constant, and no attempt was made to secure unusual constancy, for the reason that the circuit arrangement used enabled us to work the lamps under the conditions ordinarily existing in central station practice The results may therefore be considered as a better indication of what lamp users may reasonably expect from similar lamps, than if the lamps had been run at an unvarying voltage. From readings taken on different days, and at different times of day, I think the average voltage was about 99.

"The lamps under test and the test lamp itself were all in parallel. They were wired with No. 14 wire, and all connections carefully made, so that there should be no appreciable drop or fall of potential in these wires and connections. The absence of such drop was verified by proper measurements. While these measurements were being taken, the voltmeter needle was often unsteady, obliging us to wait for periods when it was steady at the proper reading, before current readings could be made. The arrangement of the lamps in parallel, as shown, made it unnecessary to wait for such periods of steady and proper voltage, before taking the photometer readings; the slight momentary variations of voltage from the correct value affected the candle power of both lamps alike within the range allowed in reading.

"The tables and curves give the results obtained. Tables I. and II. give, for each of the lots, the number of lamps burning, the observed candle power (average of each lot) and the average watts per lamp, at the several times at which readings were taken. From these readings, the percentage of initial candle power, the efficiency and the candle power per watt were computed and inserted in these tables.

"The values of tables I. and II. are plotted in terms of candle power and time in curve *A* (page 84), of percentage of initial candle power and time in curve *B*, and of efficiency and time in curve *C*. As shown by these curves, Lot 1 shows a marked increase in candle power on the start, reaching a maximum of 17.9 candles at about 175 hours, then decreases uniformly until 600 hours, when a more rapid decrease sets in. The candle power does not fall to its initial value of 15.54 candles until over 700 hours from the start. Lot 2 shows only a moderate rise in candle power, with a maximum at about 150 hours, and then decreases uniformly to its initial value at 400 hours. It shows also a sharp increase in declining brightness at 600 hours. This change may have been produced by strain due to abnormally high voltage at soon after the 600 hour point. Such a high voltage was observed for some time during the day preceding the evening on which the readings at 696 hours were taken. Curve *C* shows a marked increase in efficiency for Lot 1 on the start, falling back to the initial value only after 600 hours. Lot 2 improves in efficiency also at the start, though to a smaller extent, and continues at a practically uniform figure for 600 hours. The decrease in efficiency for each lot after 600 hours is much less rapid than that usually met with.

"Tables III. and IV., giving the total kilowatt hours spent on each lot of lamps and the total candle power hours obtained from them, are of much interest, as are also the deduced columns showing total cost of light and average cost in cents of one candle power hour.

"It will be noticed that the breakage is remarkably small. No lamp of either lot showed any serious blackening, and the majority of the lamps were scarcely blackened at all."

The report ends by saying that, taking economy, maintenance of candle power and freedom from blackening into account, the results obtained are much superior to any heretofore published, and the New York & Ohio company of Warren, Ohio, is to be congratulated upon its achievement in the manufacture of incandescent lamps.

TABLE I.—AVERAGE OF LOT NO. 1.

| Hours from Start of Test. | Number Lamps Burning | Candle Power | Per Cent of Initial Candle Power. | Watts per Lamp. | Watts per Candle Power. | Candle Power per Watt. |
|---|---|---|---|---|---|---|
| 0 | 25 | 15 54 | 100 | 61.00 | 3 93 | .254 |
| 96 | 25 | 17 38 | 113.2 | 63 12 | 3 59 | .279 |
| 144 | 25 | 17.84 | 115.0 | 63.62 | 3.57 | .280 |
| 192 | 25 | 17.82 | 115 0 | 63 54 | 3.57 | .280 |
| 252 | 25 | 17 53 | 113.0 | 63 55 | 3.63 | .275 |
| 312 | 25 | 17.30 | 111.4 | 63.41 | 3 66 | .273 |
| 360 | 24 | 17 04 | 110 0 | 63.30 | 3.70 | .270 |
| 408 | 24 | 17.08 | 110 0 | 63.30 | 3.70 | .270 |
| 480 | 24 | 16.68 | 107.5 | 63.00 | 3.78 | .265 |
| 528 | 24 | 16.70 | 107.5 | 62.73 | 3.76 | .266 |
| 600 | 24 | 16 35 | 105.3 | 62.64 | 3.83 | .261 |
| 648 | 23 | 16.07 | 103.4 | 62.60 | 3 90 | .256 |
| 696 | 22 | 15 83 | 102 0 | 62.60 | 3 95 | .253 |
| 768 | 22 | 14 81 | 95 3 | 61 94 | 4 17 | .240 |
| 812 | 22 | 14.50 | 93.3 | 61.51 | 4.24 | .236 |

TABLE II.—AVERAGE OF LOT NO. 2.

| Hours from Start of Test. | Number Lamps Burning. | Candle Power. | Per Cent of Initial Candle Power. | Watts per Lamp. | Watts per Candle Power. | Candle Power per Watt. |
|---|---|---|---|---|---|---|
| 0 | 25 | 14 77 | 100 | 49.70 | 3 36 | .298 |
| 96 | 25 | 15 06 | 102 | 50.00 | 3.32 | .301 |
| 144 | 25 | 15 13 | 102 5 | 50.23 | 3 32 | .301 |
| 192 | 25 | 15.01 | 101.8 | 49.96 | 3 30 | .303 |
| 252 | 25 | 14.93 | 101.2 | 50.10 | 3 35 | .299 |
| 312 | 24 | 14 85 | 100 5 | 49.78 | 3.35 | .299 |
| 360 | 24 | 14 82 | 100 3 | 49.76 | 3 36 | .298 |
| 408 | 24 | 14.67 | 99 3 | 49 70 | 3.39 | .295 |
| 480 | 24 | 14 65 | 99 3 | 49.52 | 3.39 | .295 |
| 528 | 24 | 14.70 | 99.3 | 49.31 | 3.36 | .298 |
| 600 | 24 | 14.50 | 98 2 | 49.33 | 3.40 | .294 |
| 648 | 24 | 14.16 | 96.0 | 49 00 | 3.46 | .289 |
| 696 | 24 | 13 87 | 94.0 | 48 92 | 3.53 | .283 |
| 768 | 24 | 13 29 | 90.0 | 48.50 | 3 65 | .274 |
| 812 | 24 | 12 97 | 88.0 | 48 25 | 3 72 | .269 |

TABLE III.—ECONOMIC RESULTS, LOT 1.

| Hours from Start. | Total Candle Power Hours. | Total Kilowatt Hours. | Total Cost of Light. | Average Cost in Cents of one C.P Hour | Remarks. |
|---|---|---|---|---|---|
| 100 | 41,500 | 155.25 | $ 36.05 | .0869 | Cost of light based on assumed price of 20 cents per lamp, and 20 cents per kilowatt hour. Figures in last column obtained by dividing cost in fourth column by corresponding figures in second column. |
| 200 | 89,950 | 314 00 | 67.80 | .0754 | |
| 300 | 133,870 | 472.80 | 99 52 | .0744 | |
| 400 | 175,930 | 628 0 | 130 60 | .0742 | |
| 500 | 216,470 | 779.3 | 160.86 | .0743 | |
| 600 | 256,090 | 929.9 | 190.98 | .0746 | |
| 700 | 292.100 | 1,071 2 | 219 24 | .0751 | |
| 800 | 325,500 | 1,207.7 | 246.54 | .0757 | |

TABLE IV.—ECONOMIC RESULTS, LOT 2.

| Hours from Start. | Total Candle Power Hours. | Total Kilowatt Hours. | Total Cost of Light. | Average Cost in Cents of one C.P. Hour. | Remarks. |
|---|---|---|---|---|---|
| 100 | 37,320 | 124.50 | $ 29 90 | .0801 | Cost of light based on assumed price of 20 cents per lamp, and 20 cents per kilowatt hour. Figures in last column obtained by dividing cost of light in fourth column by corresponding figures in second column. |
| 200 | 75,020 | 249 90 | 54 98 | .0733 | |
| 300 | 112,370 | 374.80 | 79.96 | .0712 | |
| 400 | 147,910 | 494 20 | 103 84 | .0702 | |
| 500 | 183,220 | 613.20 | 127 64 | .0697 | |
| 600 | 218,170 | 731.70 | 151.31 | .0694 | |
| 700 | 252,130 | 894 40 | 174 88 | .06936 | |
| 800 | 284,320 | 966 10 | 198.22 | .0697 | |

## Baltimore-Washington Electric Railways.

The contract for the building of the roadbed of the Columbian & Maryland electric railway, which will connect Baltimore and Washington over a thirty-six-mile route, has been awarded to E. D. Smith & Son of Philadelphia, the cost of construction, including a branch to Ellicott City, being about $3,000,000. The work will be begun at once, and it is to be completed within a year. .

A contract for a second electric road between Baltimore and Washington is about to be signed in New York. The enterprise is backed by the Washington, Sandy Springs & Baltimore Electric Railway company. The capital stock of the company is $1,000,000. In planning the Sandy Springs route, the aim has been to traverse a developing section not now reached by railroads. The Columbia & Maryland line, on the other hand, has been surveyed with a view of running express trains between the two cities over the shortest possible route in competition with the Pennsylvania and Baltimore & Ohio railroads.

## Weather Predictions by Telephone.

Prof. E. B. Garriott, the new head of the weather bureau at Chicago, announces that the bureau will henceforth make particular efforts to serve those interests that are likely to be injuriously affected by unusual weather conditions. Timely warnings by telephone are to be features. He also says that his department is making up a list of railroads, corporations, firms and individuals who desire special warnings by telephone for the protection of their business interests, and will place thereon any additional names that may be sent to him.

## Electric Coal Cutting in Scotland.

George A. Mitchell gives some statistics as to the relative cost at a mine in Scotland of coal cutting by electricity and by hand. The machine used is 7¾ feet long, 40 inches broad and 23 inches high, and is of Mr. Mitchell's design. The frame is made of steel, and the total weight is about 3,225 pounds. There is a strong sheet-iron covering over the motor, and there are also bands over the toothed wheels to prevent breakage by falls from the roof. The motor is series-wound. The only disadvantage is that the speed becomes rather high where there is no load, the revolutions increasing, as tested, to 1,300 per minute. A shunt-wound motor would give a more constant speed, but it has not the same power for starting, although there are devices for overcoming this difficulty.

The speed for which the motor is designed is 600 to 700 revolutions per minute, and it gives 12 effective brake horse power, although it will work up to a greater power if necessary.

The cutter is of the disk type, and is intended to combine the advantages of two well-known machines, which are worked in Scotland by compressed air—the Rigg and Meiklejohn and the Gillott and Copley machines. These machines differ from each other in several important particulars. The Rigg machine has a disk which works on the level of the pavement at the comparatively high speed of 60 or 70 or more revolutions per minute, and which has generally only about six cutters in the circumference. The picks enter the cut in the front, and turn toward the back of the cut. The Gillott machine has a disk which cuts above the rail level; the disk works at the slow speed of about 15 revolutions per minute, and it has about 20 cutters in the circumference. The disk turns from the back of the cut to the front, the aim, apparently, being to draw the machine into the coalface rather than thrust it out from it. In working, this machine is slightly tilted up by raising the sleepers at the outside, and the disk slopes from a few inches above the pavement in front of the cut to the pavement at the back. The disadvantage of this arrangement is that if the pavement below the holing be hard the picks are apt to be blunted by striking against it at the back of the cut, and if there be a coal-holing there is some waste of coal in the front, or, if there be a fire clay holing there is the necessity of cleaning the fire clay from the coal at the back of the cut. The advantage is that the disk clears itself better of the cuttings than in the Rigg machine, as there is no obstruction to prevent these from going between the rails. The width of the machine can also be made rather less, as in the Rigg machine some extra width is required to allow room for the extra projection of the bevel wheel, which gears into the rack on the disk. The question of the width is one of very great importance where the tendency of the roof is to be soft.

The general effect of the higher speed of the Rigg machine seems, in practice, to be to make it more suitable for a coal holing, and the Gillott cutter, on the other hand, is generally more successful where the holing is fire clay or daugh. The direction of the motion of the disk seems to matter little in practice.

The holing of the coal seam for which the cutter was designed is daugh and fire clay, varying in thickness, but generally easily cut. As thought most suitable for this holing, the disk of the machine was designed to run at a comparatively slow speed—about 25 revolutions per minute—and there are 20 picks on the circumference, fixed somewhat similarly to those in the Gillott machine. The disk, on the other hand, is supported in its place similarly to the Rigg machine, and cuts level with the pavement. The cut is three feet in depth and about 3½ inches in height. The speed of the motor is reduced by gearing, there being in all four shafts, including the armature shaft of the motor. The disc is turned by means of a bevel wheel, which gears into a rack on a disk inside the circumference.

For oiling the bearing of the disk, there is a large cup in the cast-iron bracke supporting the disk; this cup is covered by a sheet-iron lid (which is screwed on), and is filled once in each shift with waste soaked in oil. The brass under the bracket near the frame, which keeps the disk horizontal, cannot in practice be lubricated at all.

The machine is drawn forward by means of a flexible wire rope, which passes round a drum in the framework of the machine, round a pulley fixed to a prop some distance in front, and back to the machine, where it is fixed to the frame. The drum is turned by means of an eccentric on one of the shafts, which gives a reciprocating motion to a pawl; this catches the teeth of a ratchet wheel, keyed on a shaft which is geared to the shaft whereon the drum is fixed. By means of a slot, the feed may be varied, the pawl taking one to three teeth for each motion as desired.

The switch for reversing the motor has two sets of resistances and three steps, so that the current may be gradually turned off or on. There is also a small auxiliary rapid cut-off switch, which has been found convenient for use throughout the shift, and which is cheap and easily repaired.

Four men are required to work the machine. One man attends to the switch, etc., and sees that the disk is cutting rightly; he also hands the rails and sleepers over the machine, and puts up gibs along with another man who also shovels out the cuttings. The other two men lay the rails and put up timber.

A great part of the work consists in handling the rails, and on the expedition with which this is done greatly depends the length of the wall that can be cut.

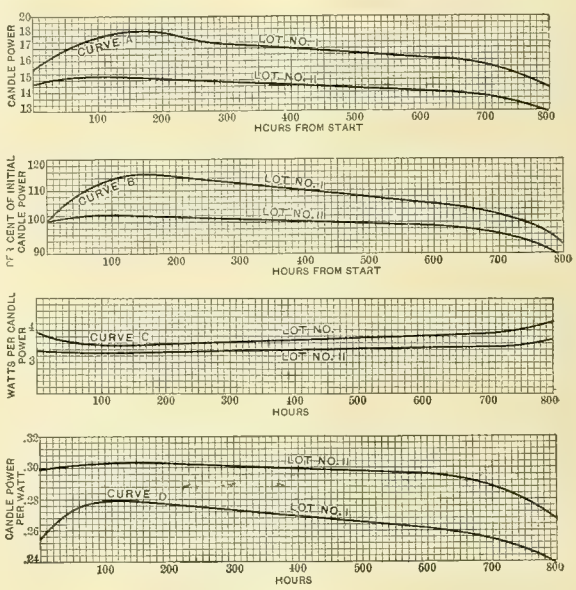
The machine has regularly cut 420 feet in length, three feet deep, in a shift of 10 hours. When cutting in the ordinary holing it easily cuts three feet in 1½ minutes, and can do so continuously when it is kept in rails.

The comparison between the cost of working by hand and by machine may be taken as follows:

| | Per Ton. s. d. |
|---|---|
| Cutting and filling by hand ... ..... 18. 8d. to | 1 10 |
| Cutting by machine, including cutting-out at each end of the wall ..... | 0 3.5 |
| Filling, which has varied from 1s 1d. to 1s. 3d. per ton.. | 1 3 0 |
| Fuel (estimated) ..... ..... ..... ..... .... | 0 0 5 |
| Upkeep and attendance on surface, sharpening picks, etc.. | 0 1.5 |
| Interest and depreciation..... | 0 1.5 |
| Total ..... ... ..... ..... | 1 10 |

This statement shows no saving, but there are other points which must be considered, besides the actual cost per ton at the face. There is less dross and larger coal produced from the machine walls. There is a much larger output from the same faces, and therefore a less cost of upkeep for roads. There being a greater concentration of output, the haulage can be more economically managed. On the other hand, the wall advances so quickly that the driving of slope roads will be more costly than in ordinary circumstances, as they must be made more expeditiously than is usually the case.

Various savings can be made in the items named where there are more cutters at work, and the writer anticipates that while there may not be a great saving over hand labor at Glenclelland colliery, yet there will be some clear advantage in the use of machines. It seems to be very much, as often stated, that the use of machines is only advantageous if the circumstances are favorable, and that there is no great saving in ordinary cases when wages are low. The essentials are a clean field and a strong roof, and the harder the holing the greater will be the saving. As regards the use of electricity instead of compressed air, there seems little doubt that the former method of transmitting power must supersede the latter, except possibly where there is fire-damp present, or where the workings are wet. There is some danger from the sparking of the brushes in an explosive mixture, though this difficulty will no doubt be got rid of in the future. Meantime caution must be exercised. With water falling it might be difficult to keep the resistance of the armature right, and any colliery owners who have wet workings should consider this defect before adopting electricity.




INCANDESCENT LAMP TEST.

The only advantages of electricity that need be named here are the greater efficiency, the convenience of erecting wires instead of laying heavy pipes, and the facility with which the results of cutting may be observed. There is also the feature that the power given out by the dynamo is in proportion to the power required at the motor, and may rise, temporarily, without damage much above the average, when for any reason extra power is required.

From experience of the machinery, breakdowns are no more likely to occur with electric than with compressed air machines, and the parts that require renewal and repair are the parts which are the same in machines driven by either power.

There is very little difference in the first cost between plants worked by compressed air and by electricity. The cost of upkeep should be much the same. For very thin seams, lighter machines should be made. This can be done by giving the motor a higher speed, and by working with less power. It is by no means clear that a lighter machine, cutting more slowly, will not cut nearly as much as the heavier machine, as it might be possible to keep it cutting more regularly with fewer stoppages. An important point about all machines is the regularity of feed; jerks should be avoided, and the aim should be to keep the cutter traveling forward as steadily as possible.

A Colorado Springs dispatch says: "A company backed by New York and Philadelphia men is arranging to build an electric car line to the Garden of the Gods. It is also proposed to build at the garden a huge structure to be known as Palm Palace. It will be an immense conservatory, like the Horticultural Building at the World's Fair."

## Large Jewell Belt.

The manufacture of electrical apparatus and the development of allied interests have brought about many interesting changes of late years, and in no industry has this influence been felt so greatly as in the production of belts. Electrical work has called for large belting in the past, but what is said to be the largest belt in the world is that just furnished by the Jewell Belting company of Hartford, Conn., to the Washburn & Moen Manufacturing company. This belt is 118 feet long, 78 inches wide and four ply, and weighs considerably more than a ton and a half. Fig. 1 shows the belt rolled up as it appeared before shipment from the factory and Fig. 2 shows it in position at the works of the Washburn & Moen Manufacturing company at Worcester, Mass., where the increased demand for electric wire has necessitated an increase in the power plant. The belt will be called upon, when running its full load, to transmit 2,000 horse power. It will be used to run nine mills, comprising at least two-thirds of the power consumed in the Grove street works. This belt has now been in use over a month, and is running as true and steady as an ordinary narrow single belt. It is worth noting that on the same day on which the Jewell company received the order for this 78-inch belt it also received an order for five 62-inch three-ply belts for the Cincinnati Street Railway company. It is safe to say that the combination of the Cincinnati belts and this 78-inch belt is the largest number of very large belts ever ordered from one company in a single day.

## Long Tree Insulator.

In relation to the device illustrated by the cut, designed to prevent the abrasion by trees of the insulating coverings of electrical conductors, W. F. D. Crane writes as follows:

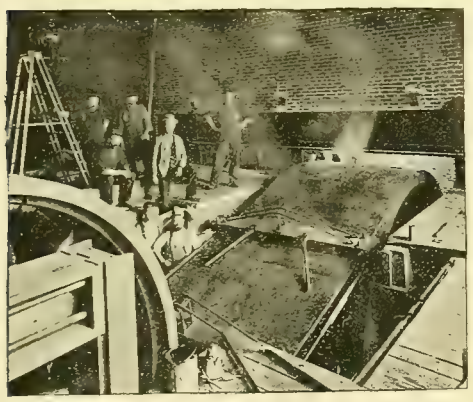


FIG. 2. LARGE JEWELL BELT.

"The writer a short time since, in looking over some numbers of your valuable journal, came upon the statement of an electrical engineer that there was an emphatic demand among electric light and railway men for a suitable insulator for protecting the insulating coverings on wires running through trees or coming in contact with obstructions along the line. He instanced as a valuable protection for this purpose the moulded mica tree insulator in halves, which has for several years past been the only device on the market for this purpose. He, however, mentioned the objection that it was too short, owing to the fact that occasionally branches swaying in the wind would leave the insulator and come down upon the covering of the wire. In order to provide a protector which would be long enough, a tree insulator made of preserved wood was put on the market some time ago, running in lengths from 12 to 18 inches, thus filling all the conditions. The device offers a valuable protection against the abrasion of the insulating covering and in many cases has proved a positive cure for losses and dangerous leakages. This insulator was patented by Thomas Hawkin in 1886. For the benefit of many electric light and railway engineers, who would appreciate a well made, strong and practicable protector for the wires, it might be mentioned that the insulators are furnished by the H. W. Johns Manufacturing company, 240 Randolph street, Chicago, and by its other houses in Philadelphia, Boston and New York."

## Mianus Desk Telephone.

The Mianus Electric company of Mianus, Conn., has just brought out the granular carbon desk telephone shown by the cut. This instrument is fitted with the company's new No. 8 granular carbon transmitter that has met with such general approval for short and long distance work. The cut shows the desk transmitter. It has an induction coil but is not wired otherwise, but can be wired for a warehouse or any system where one or more calls are required. The Mianus company sells a large number this way to telephone manufacturers, who wire them to suit [illegible]. The instruments are also fitted with push-button, buzzer and receiver complete, ready for use. The company also makes silver chime magneto bells, Blake and Ball transmitters.

## Not a Model

Electrical news from the Pacific coast is always interesting and frequently startling. A plant has now been discovered in California, it appears, that is in perfect contrast to all that is good in power house construction. The *Pacific*

MIANUS DESK TELEPHONE

*Electrician* prints the following as facts noted by an engineer in examining this "terrible example:"

A barn seems to be the proper kind of a building in which to place electric machinery, engines, boilers, etc., for a central station; that is, if the barn happens to be located in the central part of the city.

I think this station one of the best and most conveniently arranged places I have ever seen—for a man in poor circumstances, who has an accident insurance policy or is desirous of assisting his family by sacrificing a few limbs for good fat damages. High-speed belts are more plentiful than passage-ways, and there are no guards or rails to prevent a man from trying the speed of the belts. In fact, there are some things that would be of considerable assistance to him in such an undertaking. There are belts running just a little below the surface of the floor, which is well lubricated and slushed.

If a man got into one of the belts, or took a few turns around the unprotected ends of one of the shafts, I think that his family would be entitled to all that the law allows.

Speaking of the floor, it was impossible to tell what it was made of. However, there was oil and dirt in a great number of layers. One of the attendants was directed to clean

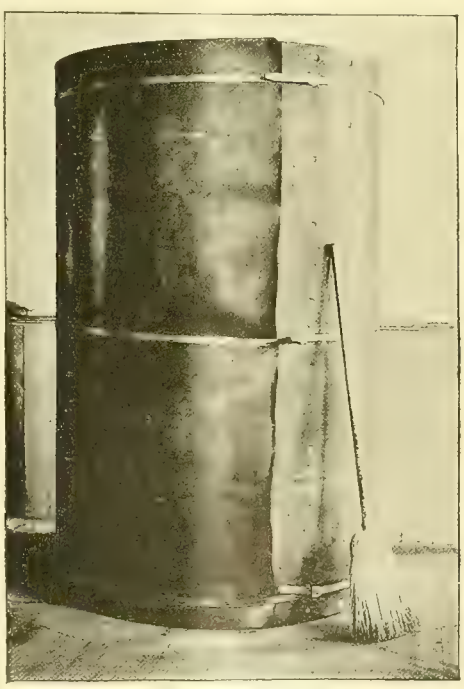


FIG. 1. LARGE JEWELL BELT.

up the floor, and started in with a hoe. I advised him to get a plow to start with, but he thought he could find bottom after awhile without it. No rubber mats are used around the dynamos, and on asking if there were none around, I was informed that oil insulation was the latest fad. This is certainly an economical idea in a place where two 50 light arc machines are run in series.

All station and switchboard wiring is done with weather-proof wire, whether it be a 1,000 volt alternating circuit or a 4,000 volt arc circuit.

The switchboard connections are a puzzle beyond solution, and the arc switch switchboard is located in a small bay, with the incandescent switchboard in front, making practically a closet of it. This closet seemed to me peculiarly adapted for electrocution purposes.

Light where it is manufactured seems to be a luxury. There are in this station eleven 16 candle power incandescent lamps and one poor arc lump to give the necessary light to operate five engines and 10 dynamos. As for reading the instruments during the tests, I found it necessary to use a lantern. This lantern was, I suppose, the emergency light of the station, and had a globe which I was told was broken last winter. All the lantern oil in the place was in the lantern, and lasted about two hours. The interesting points were very numerous, but their general tenor was monotonous and uniform, and it is needless to say that the station was not paying very large dividends.

## Electrical Compensation.

Attention has been called to the disastrous results, both direct and indirect, of the enormous inroads of electricity in street railway traffic, displacing horses, and, to a lesser degree in mine haulage, replacing mules. The effect on the farmers who raise horses and mules and the grain necessary for their subsistence, and on the railways which transport this grain, is looked at as a very serious matter, says the *Engineering and Mining Journal*. As is usually the case, however, the favorable balance is more than maintained by increased activity in other lines, due directly to the same causes. The production of copper, for instance, is enormously increased by the demands of the manufacturers of electric apparatus, and its transportation, together with the carrying of the finished products, makes an enormous freight tonnage. The auxiliary lines, so to speak, such as mica mining, asbestos mining, iron mining, and the metallurgical processes producing iron, steel and copper, have all received their share of the impetus due to electrical development. So, while the farmer may suffer in furnishing the supplies for horses and breeders, still he would gain in the general growth of industry requiring more men and more material of various kinds. Every improvement hastens the death of some industry unfit to survive, while it creates many new wants and increases the general prosperity.

## An Italian Electrical Engineer in London.

[From the London *Electrical Engineer*.]

Signor Guido Semerzi, an intelligent Italian electrical engineer, who recently visited some of our London central stations, has written a really funny account of his experiences while sojourning here. It is so funny that possibly when they read it some of the firms who unsuspectingly con-

LONG TREE INSULATOR.

ducted this *anguis in herba* over their works, and gave him full details of their plant, would like to see him again with a different object. To begin with, Sgr. Semenza avers "that England is certainly not one of the nations which are most advanced in electricity." Then he goes on to say that it is especially in regard to the mechanical application of electricity in this country that he has been "disillusioned"—"no novelty, no tendency toward progress." We "use the two-pole dynamo to the almost absolute exclusion of other systems. Multiphase currents have with us only so far made their appearance in the laboratory, and are looked upon much as in other countries navigable balloons are regarded." Our metropolitan central stations are all alike: "a trashy entrance; an obscure alley leading to the back of a pile of buildings; then a covered passage just wide enough to let a coal cart through; on the left a pile of coal, on the right the boiler house," etc. Finally, as a parting shot, we are told that "profound observation proves that the conservative English rarely push things to perfection; apparently because they are held back by the exigencies antagonistic to progress." But Sgr. Semenza has, after all, a little to say in our favor. He admires the "readiness with which we are abandoning the slow-speed steam engine and adopting its high-speed rival;" and also our efforts as "past-masters in steam engines," to make the dynamo "above all, a simple and strong machine." And we must, we suppose, like Mark Tapley, be thankful for small mercies.

## Electric Launches Growing Popular.

[From the New York *Evening Post*.]

The electric launch industry is slowly taking root in this country, the main difficulty being that of finding places at which to recharge the storage batteries, or get new supplies of chemicals if primary batteries are used. In this respect today the owner of an electric launch is often like a nation which has a fleet but no coaling station. In Europe the rivers are so much shorter than ours, the towns are so much closer together, and the population is so much denser that we find many places where launches are in demand and highly successful. The English Thames has a fine fleet, and the continental rivers are all dotted with such craft. At Bergen, Norway, a regular line of electric launch ferry has been established, with eight boats running on a five-minute schedule across the harbor. In winter, when the schedule is shortest, the boats ply from 7 A. M. to 9:30 P. M. On an average the boats cover 37 miles daily and carry a total of 1,800 passengers. The boats, which are 25 feet long, six feet eight inches beam, and made to carry 18 passengers, are double-enders, with a screw at each end. A three-horse power motor runs each boat, and the charging station has a 30 horse power dynamo. The service is efficient and popular. It would seem that there are places in America where such a plan could be adopted with advantage. Meantime electric launches are being put on many American artificial waters, and a fleet of six is being built for the Atlanta Exposition. One genius has fitted up a trolley line along a narrow stream, and the boats, instead of carrying batteries, simply take current from a wire just as a trolley car does.

# CORRESPONDENCE.

## New York Notes.

NEW YORK, August 10.—On Monday Mayor Strong signed the aldermanic resolution giving to the People's Traction company the right to bid for the franchise for the extensive street railway system north of the Harlem, which was noticed in this correspondence last week. These lines will probably be operated by the trolley system. One line begins at Willis avenue and 134th street, and runs through the latter street to Brook avenue to Washington avenue, East 187th street, Franklin avenue or Broadway, Crotona Park, South, Prospect avenue, East 149th street, and Brook avenue. Another line begins at 149th street and the Harlem river. It runs thence through East 149th street and Bungay street to the Sound. A third line runs up Willis avenue from its intersection with 134th street, through East 135th street, Exterior street, Ogden avenue, Aqueduct avenue, 174th street or Featherbed lane, Anthony avenue, Webster avenue, and Wendover avenue to Washington avenue. Still another begins at Prospect avenue and East 169th street and runs along the street to Franklin avenue, to East 168th street, to Crestline avenue, to East 167th street, to Gerard avenue, McClelland street, Jerome and Marcher avenues to Birch street, Wolf street, Sedgwick avenue, Depot place, High Bridge and to the New York Central railroad tracks. A fifth route begins at Brook avenue and East 161st street, and runs through that street, Prospect avenue, East 169th street, Home street, West Farms road, Boston post-road, to the center of the bridge over the Bronx at Bronxdale. A sixth route established begins at East 149th street and Austin place and runs through Austin place, Whitlock avenue, Leggatt avenue, Mohawk or Wetmore avenue, Lafayette avenue, to the Bronx river. The section thus provided for is but little developed.

The Brooklyn Heights Railroad company gave its first "illuminated trolley excursion" on Wednesday evening. The cars were beautiful in bunting and colored electric lights. City Hall square was alive with people to see the start of the six cars at eight o'clock, and the excursion went through crowded streets all the way from the City Hall through Court street to Hamilton avenue, to Third avenue, and thence along to Bay Ridge, Thirteenth and Twenty-fifth avenues to Ulmer Park. Each car carried 175 lights. The cars were those ordinarily used on the Second avenue line, and differ from the company's other rolling stock only in their length. Along the top of the cars over the ventilator spaces was a row of red, amber and green incandescent lamps; below, on the edge of the roof was another row of lights, and still further down on the uprights another string. Around the front of the roof were rows of red, white and blue lights. Under the roof over the motorman's head were rows of the same color. On the dashboard a half-moon-shaped frame held colored lights set close together, and in the center of this device was a white disk with five lights in a cluster. The fronts and rears of the cars were similarly decorated. The fenders were wound about with bunting. Back of the motorman was draped a flag, and bunting was used along the tops of the cars inside and out with beautiful effect. The trolley poles and ropes were decorated with small flags. When the cars moved off they looked like miniature ferryboats on wheels, only far prettier. The trip to Ulmer Park was made without accident or incident to mar the pleasure of a large party of prominent persons who were the guests of the company. At the park the company's guests were seated at reserved tables, and refreshments were served. On the return trip the cars reached the City Hall at 11:30 P. M. President Rossiter and Secretary Williams, of the company, looked after the comfort of their guests. Six cars were run, each having a seating capacity of sixty people.

This trip proved so successful that on Thursday night the company sent three excursion cars to Bowery Bay. One started from the City Hall at 8 o'clock, one from Vanderveer Park at Flatbush and Nostrand avenues, and one from the Broadway Ferry, at the same hour. The fare each way was 10 cents, and the cars were well filled before they got to the Eastern District. The officials have not announced a schedule of rates for the use of the cars for private parties, but it is reported that for the use of a single car for six hours to go anywhere on the company's system, and its connections as far as Jamaica and Flushing, the cost will be $20. The cars will comfortably carry 60 people. President Rossiter was pleased at the reception given to the first excursion. It is understood that the theater cars are now building and will be luxuriously fitted up.

A. G.

## Washington, D. C.

WASHINGTON, August 10.—Kennedy & Du Perow have just closed the sale of a 300 light dynamo to the Corcoran estate, which will place it in the Corcoran building. This firm has also completed the delivery of all the material to be used in the new telephone plant at the Government Hospital for the Insane.

Articles of incorporation were filed this week by the Standard Telephone company of Washington and Baltimore, with a capital stock of $140,000. The following named directors will manage the company: John W. Woodland, Bruce B. Gootee, Felix Agnus, William S. Thomas and Robert M. Galt. The incorporators were John W. Woodland, Bruce Gootee, Theodore J. Mayer, Eldridge Johnson, George W. Cross, Felix Agnus, Robert M. Galt, Lemon J. Hine, Frank Hume and William W. Fierce. The object of the corporation is to purchase, sell, lease and operate telegraph or telephone lines from any point within the state of Maryland.

C. Schneider is doing the electric wiring for the church on the corner of Sixteenth and Corcoran streets and overhauling the defective wiring at the Porter flats.

President Bryon of the Chesapeake & Potomac Telephone company has had several consultations with Commissioner Truesdell regarding an infringement by the District government on the Berliner patent held by the local telephone company, dated November, 1891. He has examined the instruments which the commissioners used recently when they connected the offices of the new District building with a telephone service, which they got very cheaply from the Manhattan Telephone company. President Bryon said positively on examining these instruments that they were infringements on the Berliner patents. Commissioner Truesdell has stated that a notice might have been served on the District, but he knew nothing of it. But it is understood the matter has been referred to the attorney for the District, and if the commissioners have been the cause of bringing a lawsuit upon the District they are not aware of it.

The proposed electric line into Montgomery county from the terminus of the Brightwood road will be under course of construction in a short time. The Washington, Woodside and Forest Glen Railway & Power company has been chartered, and the attorneys for the road have been authorized to begin condemnation proceedings of the land needed for the route in accordance with a recent decree of the Maryland Court of Appeals.

The proposed widening of G street necessitates the removing of several poles belonging to the Western Union Telegraph company, and this circumstance has raised a question concerning the permanency of the overhead wire system. It has been stated that the commissioners will use the present opportunity to test the question as to a continuance of the system in the District. This is authoritatively denied, however. The only step that has been taken was by Commissioner Powell, who sent a request to the manager of the Western Union company for the construction of an underground conduit on G street, in view of the necessity for the displacement of the poles. It was thought that the company would be willing to do this as a measure of convenience and economy, while the street is broken, but no order was issued, nor will there be. It rests with the company to dispose of its wires in the best way available. Major Powell stated that power has not been conferred upon the commissioners by which they can disturb the privileges conferred upon the company. Until Congress orders all wires to be put underground the commissioners can take no action as against vested rights, and as a matter of fact the only legislation upon the subject is in the nature of a request.

An official announcement has been received of the international exhibition to be held in Montreal, Canada, next year. The exibition will open in May and close in October. The exhibition, it is said, will be on a larger scale than any previously undertaken by any country under the British empire. The buildings will be twenty-seven in number, and the finest building will be that devoted to electricity.

B. Franklin Montgomery, telegraphic secretary of the executive mansion, has gone to Millwood, Va., where, with his interesting young family, he will spend the month of August.

W.

## St. Louis, Mo.

ST. LOUIS, August 9.—Contracts have been let for the complete construction and equipment of the Kirkwood and St. Louis electric railroad. The new road will be some ten miles in length, extending in almost an air line from the city limits westward through Brentwood, Maplewood, Webster Groves, Webster Park, Tuxedo and Kirkwood to Meramec Highlands on the Meramec river. The power station will be located at Brentwood on a plot of seven acres of ground. The cars will be of the standard steam railway pattern, capable of seating 52 passengers, and each equipped with two 50 horse power Westinghouse motors. The county franchise permits a speed of 20 miles an hour. The initial equipment of rolling stock will consist of five cars. G. W. Baumhoff, the general contractor for the entire work, has divided it among sub-contractors, and the entire work will be pushed forward to an early completion. This road has been promoted by D. J. Houseman of Kirkwood. It traverses the most populous suburban district in St. Louis county, and parallels the Missouri Pacific and the St. Louis and San Francisco railroads. It will make connection with the Lindel street railway at the city limits. The line will be substantially constructed and will cost some $300,000.

The Southwestern railway was put into operation last week. The new line belongs to the National Railway company and extends from Chippewa and Grand avenue eastward along Chippewa street to Broadway, thence over the tracks of the Broadway cable road to Wyoming street; thence over the Seventh street electric line to Walnut street, and thence over the Fair Grounds and Cass avenue road to Cass avenue, where in terminates. With the opening of this new line the National Railway company has instituted a system of transfers between all divisions of the company. The following named lines are now controlled by the National company: The Cass avenue and Fair Grounds, the Northern Central, the Union Line, the Citizens' railroad, the Baden and St. Louis railroad, the Southwestern and the Broadway cable line, and all except the Broadway cable are electric lines and are operated from one power house.

The project for the consolidation of all street railway companies in St. Louis has been revived again. It was first reported that an English syndicate had been induced to buy up the St. Louis roads. This report gained currency through the fact that James Campbell, the St. Louis capitalist who has long entertained this idea, was then returning from London, where it was supposed he had perfected all financial matters pertaining to the deal. Following this comes a report that the Chicago syndicate—the National Railway company—was to absorb the other St. Louis roads. But after all this the managers of the St. Louis roads say there is nothing in either of these reports. However desirable and advantageous this consolidation of street railway interests might be, there are many difficulties in the way.

The city of Fulton, Mo., is putting in a municipal plant and will also do commercial incandescent lighting. A 3,000 light Westinghouse alternating plant will be installed.

The Kansas City Stock Yards company is also putting in a 3,000 light Westinghouse alternating plant.

The City Council has adopted a resolution providing for the appointment of a committee to fully investigate the subject of underground conduits.

The Jefferson avenue railroad is now being changed for electric power.

R. J. H.

# PERSONAL.

A. E. Kennelly has received from the Western University of Pennsylvania the degree of doctor of science, in recognition of his electrical work.

General Manager J. T. Hambay, of the Beacon Lamp company, Boston, Mass., visited Chicago last week. Mr. Hambay is on a flying western trip in the interests of his company.

William C. Benbow, who, for the last six or seven years, has been with the engineering and mining departments of the Thomson-Houston and General Electric companies, has recently resigned his position to assume the management of the mines of the Cambridge & Guernsey Consolidated Fuel company at Cambridge, Ohio.

Elbert C. Ferguson, of the law firm of Ferguson & Goodnow, Chicago, read a paper before the National Commercial Lawyers' convention, in session at Detroit, Mich., August 13th, 14th and 15th, on the subject "Diversity of Commercial Laws and the Remedy." Mr. Ferguson, who was accompanied by his wife, is one of the leading commercial and corporation lawyers in Chicago and a capable writer.

John R. Markle has resigned his position as western manager for the Electric Storage Battery company of Philadelphia, to give his undivided attention to other interests. He has been succeeded by C. W. Woodward, late of the home office of the company, who will open a new Chicago office and storeroom for the sale of chloride batteries. Mr. Woodward has had wide experience in the storage battery business, having served five years with the Accumulator company, and will undoubtedly push the Chicago end of the business for all it is worth. Pierce & Richardson have relinquished the local agency, but will be retained as consulting engineers to the Chicago office under the new arrangement.

# ELECTRIC LIGHTING.

The village council of Ontonagon, Mich., has awarded the contract for a village electric lighting plant to the Electrical Engineering company of Minneapolis. A Siemens & Halske dynamo will be used.

The Dalton & Fork Mining company of Bingham, Utah, has recently put in a 100 light Dayton dynamo to light its shafts, mines and buildings. The plant was installed by R. W. Nicol, contracting electrician of Salt Lake City.

The contract for building the electric light station at Chicopee, Mass., has been given to D. G. Canty, and a sum not to exceed $16,500 will be devoted to this purpose; $20,000 was appropriated for putting up the entire plant, and the city property committee was authorized to award the con-

tract for equipping the station and to hire an expert to install it at a cost not exceeding $1,000.

A 400 horse power engine was completely wrecked in the plant of the San Antonio, Tex., Gas & Electric Light company on August 1st by the blowing out of a cylinder head. The company managed to take care of its customers, and a new engine was ordered by wire.

The Little Rock Electric Light company and the Little Rock Edison Electric Light & Power company have been consolidated under the name of the latter company. The officers are: President, Dr. C. M. Taylor; secretary, S. R. Allen; treasurer, Oscar Davis. J. A. Van Etten will be the manager of the consolidated companies.

## ELECTRIC RAILWAYS.

The Augusta, Ga., Street Railway company will extend its Harrisburg line through Broad and Milledge streets to Lake Olmstead.

The Chicago City Railway company has accepted the ordinance for an overhead trolley line in Clark street and will begin work on the improvement at once.

By the failure to throw a switch a disastrous trolley car collision occurred in Indianapolis on August 9th. There were no fatalities, but from 12 to 20 persons were painfully injured.

A City of Mexico special to the *Boston Herald* says the first concession for an electric railway has been granted there. The concessionaire, John B. Frisbie, is an American, but a long-time resident of the City of Mexico.

Within a short time there will be much activity in electric railway construction in San Francisco. Several cable lines will be replaced by trolley roads, and the Bryant street power house will be increased in capacity from 2,000 to 6,000 horse power.

The Williams Valley Street Railway company, which several weeks ago received a charter to operate a trolley road in the western end of Schuylkill county, between Tower City and Lykens, Pa., will commence the construction of the road within a few days. The right of way has been secured over the whole of the proposed route. The company has a capital stock of $100,000.

## MISCELLANEOUS.

A Scotch paper states that a warship of an entirely new type is, about to be laid down at Chatham dock-yard. Electricity is to be the motive power, and a speed of not less than thirty knots is to be developed.

The American Electro-therapeutic association will hold its fifth annual meeting at the College of Physicians and Surgeons of Ontario in Toronto, Canada, on Tuesday, Wednesday and Thursday, September 3, 4 and 5, 1895.

## TRADE NEWS.

G. T. Evans & Co., electrical engineers, Pittsburg, Pa., have just issued a valuable table for computing weights, losses, etc., of copper wires.

"The handsomest engine room in the world"—that at Keith's new theater in Boston—is described in a tasteful booklet just issued by the Harrisburg, Pa., Foundry and Machine Works. Three Harrisburg Ideal engines, aggregating 525 horse power, noiseless running and nickel-plated, furnish the power. These engines are highly praised.

The Manhattan incandescent arc lamp, represented in Illinois, Indiana, Michigan, Southern Iowa and Wisconsin by J. H. Coke, 753 Monadnock building, Chicago, is meeting with a lively reception. Orders for more than 300 lamps have been placed since April 1st. "Put in a new carbon and trim your lamps once every 100 hours; that's profit," is the Manhattan *slogan*.

Max A. Berg, the former secretary of the Wallace Electric company, has become associated with the Ohio Brass company of Mansfield, Ohio, as manager of the Chicago office, with headquarters at [illegible]. Mr. Berg, who is familiarly known to his many friends as "Max," is a bright and energetic young man, who is thoroughly familiar with the electric railway supply business. The Ohio Brass company is to be congratulated upon securing his services. In addition to handling the specialties manufactured by the Ohio Brass company, Mr. Berg intends to add several electrical novelties.

General Manager J. J. Gates of the Perkins Electric Switch Manufacturing company of Hartford, Conn., visited Chicago last week on a combined business and pleasure trip. Mr. Gates, on his way west, passed through a number of the largest cities, and after leaving Chicago he returned to Hartford. In conversation with the representative of the WESTERN ELECTRICIAN, Mr. Gates expressed himself most enthusiastically on what he considered were the prospects for his company's business this fall. The Perkins company has progressed steadily during the hard times, and Mr. Gates was so much impressed by the better feeling now existing throughout the western and middle states in the electrical trade that he returns to Hartford to advocate not only the employment of increased help, but also the introduction into the factory of a large amount of new machinery to facilitate the more rapid production of the Perkins specialties. Readers of the WESTERN ELECTRICIAN are already aware of the fact that this company's capital has been increased from $50,000 to $125,000, which was made necessary by its rapidly growing business. It is said that a large portion of the new stock is now held by men of unquestioned prominence in the business world; in a word, by such conservative holders that their purchase of the stock in itself would indicate a knowledge that the Perkins company's business is an excellent and profitable one. Mr. Gates spent most of his time while in Chicago in company with Western Agent G. W. Conover. As it is well known, Mr. Conover's work with the company has done not a little in bringing it to its present prominent position in the western and middle states.

## BUSINESS.

The American Carbon company has removed from Dayton, O., to Noblesville, Ind., where its factory is located.

The Electric Appliance company, Chicago, has taken the exclusive selling agency of the United States for that celebrated commutator preserver, Gale's compound. The price has been somewhat reduced and an increased sale is anticipated.

The Triumph Electric company of Cincinnati has opened an office with Turner Bros., 25 Marietta street, Atlanta, Ga., with E. F. Seixas, formerly with J. Holt Gates of Chicago, in charge. Mr. Seixas will draw up specifications for complete plants of all descriptions and will install and take charge of the exhibit of the Triumph company at the Cotton States Exposition, and will be pleased at all times to explain the apparatus.

The Abendroth & Root Manufacturing company, 28 Cliff street, New York city, manufacturer of the improved Root water-tube boiler, has been awarded the 626 horse power boiler contract from the Union Car company of Buffalo, N. Y., and a 500 horse power contract from the Reading Steam Heat & Power company of Reading, Pa. It is also erecting in New York city 300 horse power in the College of Physicians and Surgeons, two boilers in the Baptist Home, one in the Parmly building and two for the Sing Sing Electric Lighting company.

The Metropolitan Electric company, Chicago, has become the western selling agent for the "Ship" cored carbons. These carbons are imported from Vienna, Austria. They have already established an enviable record, and as the Metropolitan company has placed a large stock order, they will be able to fill all orders for imported carbons promptly. The same company has been appointed selling agent for the Coe electric alarm mail box. In this box the act of inserting the letter rings the house bell a predetermined length and number of times, thus distinguishing a postman from a caller. It requires no extra wiring, battery or bell.

The many friends of H. J. Gille will be interested to know that he has recently been appointed northwestern agent for the Washburn & Moen Manufacturing company. Mr. Gille, it will be remembered, had charge of the supply department of the General Electric company in St. Paul, and was also purchasing agent of the Northwest General Electric company. He has recently been in Chicago as assistant manager of the General Electric company's supply department. Mr. Gille's headquarters will be in St. Paul, Minn., and with his extensive acquaintance in the vicinity of St. Paul and Minneapolis, as well as throughout the Northwest, it is nothing more than reasonable to believe that his new venture among old friends will be a success.

The WESTERN ELECTRICIAN is in receipt of an invitation to be present at the celebration of the twenty-fifth anniversary of the founding of the business of the American Electrical Works of Providence on the 17th instant, at which time the seventeenth annual Rhode Island clambake, for which this concern has such a wide fame among the electrical fraternity, will be given at Haute Rieve, the Union Club County House, a fashionable resort a short distance from Providence. It is a great pleasure to extend hearty congratulations to President Eugene F. Phillips on the silver anniversary of his connection with this business. No one is better known throughout the United States in the endeavor to maintain a high standard in the electrical trade, and for the production of goods which shall always be known as standard. The growth of this company from a small beginning shows what the careful and intelligent management of President Phillips has accomplished.

The Belknap Motor company of Portland, Me., has recently secured the contracts for the electric lighting plants at the Maine State College, the Rumford Falls Sulphite Paper Mill company and the Ocean View Hotel at Block Island, R. I. Of that first named the *Portland Argus* says: "The Maine State College electric light plant contract has just been awarded the Belknap Motor company. This is a big card for this company and it is a credit to our state that we have an electrical manufacturing concern that can furnish it. It is equally creditable to the faculty that they had the good sense to give the contract to a home company, but it is to one fully competent to meet all the requirements. The entire plant when completed will embrace one 15 and one 30 kilowatt generator and several motors. The grounds will be supplied with four arc lights and the buildings with some 350 incandescent lamps. A storage battery will form a part of the installation. The Belknap company has already furnished them one machine which had been in use there about a year with very satisfactory results."

General Sales Agent F. S. De Ronde, of the Standard Paint company of New York, visited Chicago last week, and in conversation with a representative of the WESTERN ELECTRICIAN expressed himself as pleased with the present indications for an excellent business in the fall. Mr. De Ronde considers his best references are the many customers who have dealt with him during the past ten years. He claims that his company is selling more P. & B. than ever, his trade extending into all parts of the world. In addition to his P. & B. business, Mr. De Ronde is now interested in the concern of A. De Ronde & Co., sole agents for Schiff, Jordan & Co., Vienna, Austria, to handle this large and well-known concern's cored "Ship" carbons for arc lamps. While Mr. De Ronde's carbon interests will in no wise interfere with his work for the P. & B. company, he has thus far been able to work his carbon business as a side line in a manner that seems to indicate that the "Ship" carbons are well liked by the American trade. Mr. De Ronde has been able to pick up during his short stay in Chicago a considerable number of handsome orders. In addition to handling the business himself, he may shortly establish a number of sub-agencies for the "Ship" carbon throughout this country. The "Ship" carbon is claimed to be a high class article, giving a brilliant, steady light with the minimum current while burning. It makes no dust, this latter peculiarity being a valuable feature.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued August 6, 1895.*

543,836. Alternating Current Motor. Engelbert Arnold, Zurich, Switzerland. Application filed October 9, 1894.

The method of operating a single-phase alternating current motor is described, by supplying an alternating current to the field coils, and directing and controlling the flow of induced currents in the armature at starting, thereby producing poles and giving initial rotation to the armature, and thereafter short-circuiting the individual coils of the armature.

543,843. Telephone. John S. Biggar, San Francisco, Cal. Application filed November 16, 1894.

A means of varying the resistance of an electric circuit is shown, which consists of an electro-magnet, in the magnetic path of which is located a portion of the circuit, consisting of material whose resistance to the flow of current can be varied by the passage of magnetic lines of force through it.

543,855. Short-circuiting Device for Stopping Dental Motors. Francis N. Denison, Toronto, Can. Application filed October 9, 1894.

In combination with the motor, having a shunt field and a circuit, there is a foot switch interposed in the circuit, and a hollow base plate, having a rheostat beneath the same, the series of contacts connecting therewith, the arc-shaped contact plates connected with the poles of the armature, and the foot lever pivoted to swing both vertically and laterally, and having a contact arm for engaging the series of contacts as the pedal is swung laterally, and a second contact arm for connecting the two arc-shaped plates as the pedal is swung vertically.

543,865. Electric Meter. Jesse Harris, Lynn, Mass. Application filed October 4, 1894.

A pressure coil and a motor are employed, and a torsion spring is connected to the coil and to the motor, whereby the torsion of the spring automatically balances the torque of the coil.

543,867. Construction and Operation of Electric Railways and Tramways. Isaac W. Heysinger, Philadelphia, Pa. Application filed April 11, 1892.

In an electric railway, in combination with the rails, the continuous line of heat pipes, contiguous to rails, but separate therefrom and parallel therewith, and adapted to communicate the heat of the pipes thereto, the heat-retarding covering adapted to permit a slow and gradual emission of the heat to the rails, and waterproof protection, together with means for forcing a current of heated fluid through the pipes.

543,885. Electric Battery. Robert McL. McDonald and Alexander McDonald, Dalmuir, Scotland. Application filed November 13, 1894.

The battery cell comprises the outer jar, the inner electrode, the porous cup surrounding the same, the cinders within the jar, and the spiral around the porous cup, the spiral acting as a conductor and serving to retain the cinders in place, the cinders being supported between the spiral and the jar.

543,892. Method of and Means for Extinguishing Electric Arcs. William B. Potter, Schenectady, N. Y. Application filed November 30, 1894.

The method of extinguishing an electric arc consists in restraining the path of the arc to a line of direction substantially transverse to the lines of force from an arc-disrupting means tending to extinguish it.

543,895. Construction of Armatures for Dynamo-electric Machines. William B. Sayers, Bearsden, Scotland. Application filed August 16, 1894.

The method of winding armatures for dynamo-electric machines consists in fixing portions of the armature winding to the armature core, engaging other portions of the winding by a holding device, rotating the armature core with the portions of winding secured thereto, relatively to the holding device, so as to cause portions of the winding at one or at each end of the core to become bent to the required extent in a symmetrical manner about the axis of the armature, and then securing the end portions in place.

543,896. Fire Alarm. Charles F. Scofield, Bridgeport, Ala. Application filed August 16, 1894.

A main line wire or connection is provided with spaced fusible links or parts, a spring-actuated drum, an escapement device operatively connected with the drum for controlling the rotation thereof, the escapement mechanism including a ratchet wheel and a detent lever in engagement therewith, a branch wire or connection between the detent lever and the main line wire or connection, a spring connected with the branch wire and held compressed in order to maintain the main line wire in a taut condition an operating wheel, connections between the same and the drum, the operating wheel having a series of spaced signal pins arranged at irregular intervals to form a distinctive signal, and a spring-actuated hammer having an arm arranged in the path of the signal pins, and adapted to be actuated by its spring to strike a gong after being moved against the tension of its spring by the contact of the signal pins with the arm, which is arranged in the path thereof.

543,900. Electric Arc Lamp. Charles E. Scribner, Chicago, Ill. Application filed March 12, 1891.

The first claim follows: The combination with two arc lamps of an electro-magnet and a polarized armature therefor provided in connection with each of said lamps, a pair of contacts controlled by each of said armatures for cutting the respective lamps into and out of circuit, said electro-magnets being wound relatively to their respective polarized armatures, so that current in one direction will actuate one of said armatures to cut one lamp into circuit, while current in the opposite direction will actuate the second armature to cut the second lamp into circuit.

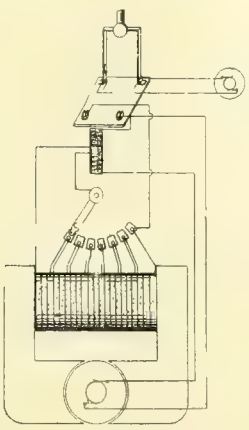
543,901. Telephone Exchange System. Charles E. Scribner, Chicago, Ill. Application filed November 12, 1894.

A telephone line, means for interrupting the line circuit at the substation, a battery in the line at the central station, two annunciators in parallel branches of the circuit at the central station, each having contact points controlled by it adapted to open the circuit through it when the current through it is interrupted, and a circuit formed temporarily in the spring jack, bridging the switch contacts of one of the annunciators.

543,902. Apparatus for Telephone Switchboards. Charles E. Scribner, Chicago, Ill. Application filed December 8, 1894.

The combination comprises a telephone circuit, a plug constituting the terminal of the circuit, a plug-seat-switch for the plug controlling the connection of an operator's telephone with the circuit, a relay also controlling the connection of the telephone with the circuit, the relay being itself controlled by circuit connections closed by the insertion of the plug into a spring-jack.

543,907. Controlling Phase Relation. Charles P. Steinmetz, Lynn, Mass. Application filed September 9, 1893.



NO. 544,118.

The arrangement in an alternating current distribution system is described, of a phase controller coupled directly or indirectly in circuit, so as to accelerate or retard the current relatively to the electromotive force as required, and a regulator responsive to changes in current strength for varying the accelerating or retarding influence.

543,919. Method of Connecting Ends of Electric Conductors. John T. Beswick, Brooklyn, N. Y. Application filed February 9, 1895.

This invention consists of a method of connecting rods or wires forming portions of an electric circuit, providing a rod or wire with a slot, inserting within the slot one of the rods or wires forming a portion of the electric circuit, and which is provided with one or more notches, and finally forcing into the notch or notches a portion or portions of the rod or wire forming the side wall or walls of the slot.

543,929. Electric Temperature Controlling Device. Sven A. Ekehorn, Milwaukee, Wis. Application filed May 1, 1894.

A thermostat is fastened at one end to vibrate at its opposite end, and is formed of two parallel extending differentially expanding sections fastened together, one section being convoluted.

543,931. Primary Battery. George H. Gardner, Boston, Mass. Application filed July 5, 1894.

A binding post having a metallic connection passing through the bottom of the cell and terminating in a flat curved spring.

543,933. Electric Signal for Railway Trains. John C. Henry, Westfield, N. J. Application filed April 20, 1895.

A magnetic electric alarm is located on the locomotive, a circuit completed throughout the train, switches arranged at the gates of the cars, and means whereby an alarm is actuated by opening any one of the gates, and the opposite alarm is given only by the closure of all of the gates.

543,950. System of Electric Distribution. Elihu Thomson, Swampscott, Mass. Application filed June 28, 1894.

A compensator for an alternating current distribution system is adapted to subdivide the potential of the delivered current, consisting of a coil, an impressing circuit connected thereto, and impressed circuits fed therefrom, the connections from the impressed circuits overlapping each other.

543,960. Electrical Conductor. Gorham Gray, Boston, Mass. Application filed December 14, 1894.

The claim: As an improved article of manufacture, an anti-inductive conductor for electric currents, consisting of a wire grooved spirally in opposite directions, so that the spirals will intersect or cut across one another at each turn or twist around the wire.

543,963. Rheostat Controller. Clyde Landers, Tacoma, Wash. Application filed March 27, 1894.

The invention comprises an upright board, having a series of plates at its upper end and a series of buttons at its lower end, the plates and buttons being connected respectively by wires, and the buttons being in circuit with a resistance coil, a series of reversing switches or segments beneath the plates, electrically connected with a series of buttons on the lower side of the board, and electrical connections between the buttons and the motors, connections between the trolley wire and one of the reversing switches or segments, and connections with the rail, an operating lever pivoted in the board, carrying a series of contact points thereon.

543,965. Electric High or Low Water Alarm. Bernard McCabe, Boston, Mass. Application filed December 15, 1894.

In a steam boiler a float, a rock shaft secured thereto, a gear on the shaft, a vertical rod arranged to turn in suitable bearings and extending outside of the boiler, a gear on its lower end engaging with the rock shaft gear, and an arm on its outer end making one electrode, and two plates on a suitable support making two independent electrodes of an electric circuit, and electrically connected with a sounding device, and electrically connected with an independent annunciator.

543,966. Circuit Closer. William Nutt, Crawfordsville, Ind. Application filed November 6, 1894.

There is the combination with a crank shaft, and an arm carried thereby, of spring contact plates adapted to be engaged by the arm, contact pins with which the contact plates are adapted to engage, and springs for maintaining the arm normally out of contact with the contact plates and returning it to its normal position.

543,978. Electric Condenser. Charles S. Bradley, Avon, N. Y. Application filed May 11, 1895.

A polyphase condenser, comprising a series of conductive plates or surfaces connected in groups with polyphase terminals, the members of the groups being interleaved with one another.

543,984. System of Multiplex Telegraphy. Thomas B. Dixon, Henderson, Ky. Application filed October 19, 1894.

The arrangement includes a line conductor, means for supplying current to the line, and transmitting instruments connected to the line conductor, a receiving instrument corresponding to one of the transmitters, a dead-beat relay controlling the receiving instrument, a second relay controlling the dead-beat relay, and adapted to cause the armature of the dead-beat relay to be deflected in the one direction or the other, according as the armature of the second relay is in proximity to its magnet or away from the magnet, and means operated through changes in the line current for operating the second relay.

543,985. Incandescent Conductor for Electric Lamps. Thomas A. Edison, Menlo Park, N. J. Application filed August 7, 1882.

A flexible carbon filament for the incandescing conductor of an electric lamp is composed of carbonized unstructural cellulose or other carbo-hydrate, or a compound thereof.

543,987. Filament for Incandescent Lamps. Thomas A. Edison, Menlo Park, N. J. Application filed October 20, 1882.

A flexible filament of carbon for the incandescing conductor of an electric lamp is formed from vegetable fiber, treated before carbonization with hydrofluoric acid.

544,034. Electric Lighting System. Edward F. Gavin, New York, N. Y. Application filed September 28, 1894.

A letter form or other lamp support is provided with holes for the bulb stems, rings of insulating material seated in rabbets surrounding the holes, sockets detachably secured to the rings, and contact pieces on the rings and sockets.

544,037. Converter System for Electric Railways. Thomas Harper, New Brunswick, N. J. Application filed June 29, 1894.

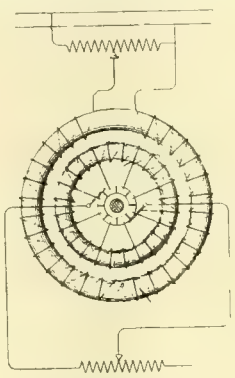
The invention consists of a transformer coil, having a closed magnetic circuit, and having a slotted conduit for the secondary coil formed in the circuit, with its axis parallel with the axis of the coil.

544,047. Rheostat. William O. Meissner, Chicago, Ill. Application filed November 20, 1893.

This is a combination of a rotatable cylinder, with a spiral ridge along it and resistance wires about it.

544,056. Conduit System for Electric Railways. James Thomas and William R. Thomas, Catasauqua, Pa. Application filed December 6, 1894.

The claim is given: In combination with a conduit, positive and negative conductors, insulating brackets for supporting said conductors in said conduit, trolley wheels adapted to engage said conductors, a trolley bar composed of two grooved plates bolted together, insulated guide plates provided with right angular flanges and bolt passages, and located upon each



NO. 543,836.

side of said bar, insulating sleeves in said bolt passages, securing bolts passing through sleeves, insulating washers between the heads, and securing nuts of said bolts and said guides, slides mounted between said guide plates and having base flanges adapted to pass under the right angular flanges, and thus guide the slides in their vertical movements, bow springs for actuating said slides; each of said springs having one end attached to the trolley bar, and the opposite end secured to its respective slide, whereby said slide is normally depressed and can rise only under spring pressure, segmental bars pivoted near their centers to said slides respectively, and adapted to support the trolley wheels upon their ends, and permit vertical movement of said wheels irrespective of the slides, and conductors for electrically connecting the slides with the car above, said conductors passing through the grooves in said trolley bar, but passing out of the same a proper distance from the tops of the slides to which they are respectively secured.

544,066. Electric Arc Lamp. John A. Mosher, Chicago, Ill. Application filed May 11, 1895.

Included in the device are a frame, a transforming agent carried by the frame, and having its secondary circuit wholly within the lamp, and a pair of movable electrodes forming a part of the secondary circuit, and means for maintaining the electrodes in continuous contact.

544,084. Fire Alarm Signaling Apparatus. Gilman W. Brown, West Newbury, Mass. Application filed September 1, 1892.

A multipolar electro-magnet having slotted poles, the sides of the slots constituting the acting surfaces of the poles, combined with a multipolar polarized armature mounted to rotate or oscillate in a plane substantially parallel with the surface and provided with beveled sides, is a feature of the invention.

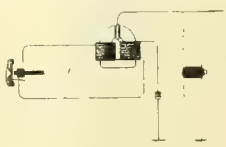
544,094. Automatic Cut-out for Electrical Converters. William J. Greene, Cedar Rapids, Ia. Application filed March 9, 1895.

There is the combination of a switch lever, the working or service converter, contact plates carried by the switch lever and adapted to connect and disconnect the converter from primary and secondary mains, a pair of electro-magnets or solenoids adapted to operate the switch lever, and means for alternately energizing the electro-magnets or solenoids, consisting of a permanent source of electrical energy, and an electro-magnet in series with the secondary circuit, and having an armature in electrical connection with the secondary circuit, and connections through the electro-magnet, armature and secondary circuit, whereby the armature alternately connects the electro-magnets or solenoids with the permanent source of electrical energy.

544,107. Magneto-electric Bell. Leland Moore, Brooklyn, N. Y. Application filed April 11, 1895.

An electro-magnet is pivoted at or near the central point of its major axis; four permanently magnetic pole pieces are arranged in pairs of similar polarity, one pair upon each side of the axial line, one or more pole pieces for the electro-magnet; sheets of spring brass are fixed in position to make contact with the poles of the permanent magnets and initiate the oscillating return movement; a hammer is fixed to the electro-magnet and a gong or sounding device.

544,118. Safety Electric Motor. William R. Polk, Jr., Atlanta, Ga. Application filed February 20, 1894.



NO. 543,843.

Combined in this motor are a field magnet, consisting of pole pieces, an exciting coil therefor, a switch having a lever spring pressed to an open position, a magnet core in the line of motion thereof, so situated as to be contacted with by the lever when the same is in closed position, a coil thereon connected terminally with a line bearing a practically constant current, and an oppositely wound coil thereon in series with the armature coil.

544,123. Electric Signaling System. Charles A. Rolfe, Chicago, Ill. Application filed January 18, 1895.

The claim: An electric signaling system, comprising a signal transmitting mechanism, from which alarm signals are transmitted over the main line; an auxiliary circuit including means for starting the signal transmitting mechanism, and also including one of the windings of a differential relay, a balancing circuit including the other winding of said relay, a battery from which the current divides between the two circuits and passes through the relay windings in opposite directions, a rheostat arranged in the balancing circuit as a means for dividing the current equally between said two circuits, and an alarm controlled by the differential relay and operating when the circuits are out of balance.

544,153. Vessel for Electrolytic Separation. Wilhelm Borchers, Duisburg, Germany. Application filed December 31, 1894.

The vessel has an interior surface with numerous grooves, one above the other, and a discharge opening from the bottom, whereby the material exposed to the electrolytic action flows downwardly from one groove to another.

544,157. Trolley Wheel. Jesse Conway, Baltimore, Md. Application filed January 4, 1895.

This trolley wheel has a central annular groove and two side flanges, each flange, one on each side of the central groove, having on its inner side a continuous spiral groove, adapted to direct the line wire from the flange to the central groove.

544,198. Electric Railway. Francis Taylor, Charlotte, N. C. Application filed November 30, 1894.

In the conduit is a live wire held at one side of the slot of a rotatable transmitting shank, having a brush at the lower end to engage the wire. A vertically movable frame is supported on the car body for carrying the shank, and mechanism is operated from the car platform for raising the frame, and for rotating the shank.

544,209. Electric Railway and Tramway. Jean Claret, Lyons, and Olivier Wuilleumier, Clermont-Ferrand, France. Application filed July 25, 1893.

A series of spaced contact surfaces, a main conductor to supply current to the surfaces in succession, in combination with an automatic distributer having terminals connected to the surfaces, and means for automatically bringing the contact surfaces successively into electrical connection with the main conductor, one at a time, and locking such connection until the succeeding contact surface is reached by the car.

544,224. Electric Alarm Lock for Tills. Charles Helm, Indianapolis, Ind. Application filed April 23, 1895.

In a till lock constructed as described there is a rocking member carrying a pivoted latch operated by a series of tumblers or wards, a latch plate pivoted to the rocking member, and a contact plate with which the latch plate engages, together with an electric bell and battery.

544,236. Controlling Switch for Electric Motors. William J. Pohlman, Woodbrook, Md. Application filed June 4, 1895.

The combination comprises an electro-magnet, an armature for the same, contacts which receive a definite movement by the vibration of the armature, brushes arranged about the contacts, a circuit-making and breaking sector having contact points normally out of engagement with adjacent contacts, a separate contact having permanent electric connection with the sector and with one pole of a battery, and a circuit for the electro-magnet, including one of the contact points on the sector, the corresponding adjacent contact, and the separate, permanently connected contact.

544,261. Alternating Current Motor. Robert Lundell, Brooklyn, N. Y. Application filed October 22, 1894.

This motor has two inductive parts provided with independent windings, the windings of one part being closed upon themselves in short circuit and disposed at angles to the radial lines of the axis or core thereof.

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## Double Swing Bridge Operated by Electrical Power.

Among the drawbridges that have been recently constructed, the one which spans the Cuyahoga river at Columbus street, Cleveland, O., has attracted an unusual amount of attention on account of several novel features which have been introduced into its design and method of operation.

It was built to replace an old swing bridge with a center pier, which was a serious obstruction to traffic on account of a sharp bend in the river at this point and the narrow passage allowed for vessels on either side of the pier. It is built on a grade, the south end being eight feet higher than the north. This is accomplished by a difference in the heights of the bearings for the loading beams, thus allowing the drum to turn in a horizontal plane.

The ends of the spans meeting at the center are necessarily convex, and the space between is bridged by means of an apron extending the full width of the bridge, which is raised when the bridge is to be swung, and which may be seen in the lower view in Fig. 1, at the end of the left-hand span.

This bridge is of especial interest to the readers of the WESTERN ELECTRICIAN, from the fact that it is operated by electricity, and all auxiliary motions are accomplished by compressed air, the compressor being driven by an electric motor.

There being two spans, the bridge is really operated by two entirely independent electric plants, each being a duplicate of the other. The current is brought to the bridge by independent lines from two different street railway circuits, and is brought to the junction box at the top of the south pier by lead-covered cables protected by iron conduit. From the junction box the mains are run through a duct leading from the outside of the masonry of the pier to the hollow center casting about which the drum turns, and are connected with stranded conductors which lead to the floor of the bridge above, Fig. 2, whence the cables continue to the main switch in the operating house. All the wires used about the bridge are lead-covered with the exception of the connection between the fixed center casting and the flooring of the bridge which turns. This of necessity must be flexible, that it may not be injured by the motion of the bridge in moving through an angle of 90° in either direction and back. For protection from moisture and mechanical injury the flexible conductors are enclosed in heavy rubber tubing. These conductors and the compressed air hose, which will be spoken of later, may be seen in Fig. 2

A double-throw switch in the operator's house enables one to take current for the bridge from either power circuit he chooses, thus rendering it practically impossible for the bridge to be crippled by a shut-down in either power house. Duplicate iron-armored submarine cables connect with the operating house on the opposite span, and double-throw switches allow the spare cable to be thrown in if any trouble develops in the one in use.

The drum of each span is revolved by means of the usual rack and pinion. A 25 horse power Westinghouse waterproof multipolar railway motor is attached to the horizontal driving shaft, Fig. 2. The controllers, Fig. 3, used were designed especially for this plant and are exceedingly simple and compact, the resistance being located beneath the floor. No reversing switch is required, a forward or backward motion of the lever giving a corresponding motion to the bridge. This controller gives the bridge a noticeably smooth start, and there is an entire absence of the arcing common in 500 volt work. Each span is provided with an automatic switch which opens the circuit in case, through carelessness or from any other cause, the bridge swings beyond 90°. In the south operating house is located an air compressor,

FIG. 1. DOUBLE SWING BRIDGE OPERATED BY ELECTRICAL POWER.—BRIDGE CLOSED AND OPEN.

was also necessary to build the abutment farther back at one end to make way for the tracks of a railroad company, which owned the right of way.

To meet all the requirements in the most satisfactory manner and at the least expense, the city engineer, Walter P. Rice, designed a double swing bridge, which proves to be the first of the kind to be built. Briefly described, the bridge consists of two independent swing spans, mounted upon piers on either side of the channel of the river, thus leaving a clear space for navigation between the protections of the piers of 121 feet. These spans are identical in construction, being 139½ feet long, and forming, when the bridge is closed, a continuous roadway of 279 feet from abutment to abutment and 20 feet wide between wheel guards, with a sidewalk six feet in width on each side.

Photographic reproductions of the bridge, open and closed, are given on this page. As may be seen, the bridge

Fig. 3, which is driven by a five horse power slow-speed Westinghouse motor, and which pumps into the receivers, Fig. 2, located beneath the floor of the bridge. These receivers also are connected with a similar set on the other span by means of a heavy lead pipe laid under the river. The connection between the fixed and movable parts of the bridge is made by means of flexible steam hose.

The compressed air is used for operating the locks at the shore end of each span and the plungers and apron at the center. The former consists of a toggle driven slightly past its center by the piston of an 11½ by 6½ inch air cylinder and fitting into two cup-shaped bearings, forming a portion of the anchorage, there being two at each end of the bridge. The apron and plungers at the center of the bridge are connected mechanically and operated by two 11½ by 19½ inch air cylinders. At either end of the bridge is a pair of safety gates of the Bogue & Mills type, also operated by compressed air under reduced pressure.

The operators' houses are models of neatness and compact arrangement. They are nine feet by five feet six inches and are located on a platform above the sidewalk, as shown in Fig. 1. With the exception of the gates at the south end, where a guard is located on account of the railroad crossing, every motion in controlling and operating the bridge is made from these houses, each pair of air cylinders having a corresponding controlling valve there. The houses are lighted by electricity and electric lamps are distributed about the bridge. The signal lanterns at the ends of the spans are fitted with two sets of lamps on independent circuits, so that in case a lamp burns out or a fuse blows, the other circuit may be instantly thrown in and the trouble remedied at leisure. A telephone in each house, connected by a cable beneath the river, enables the operators to communicate with each other when the bridge is open. Fig. 3 gives an interior view of one of the houses.

It requires less than 30 seconds to open the bridge, it thus being the quickest opening bridge on the river.

The quantities of material entering into the construction of the bridge were as follows:

| | |
|---|---|
| Total weight of superstructure (tons) | 427½ |
| Total cubic yards of masonry | 2,308 |
| Total cubic yards of concrete | 447 |
| Total lineal feet foundation piles | 12,223 |
| Total cubic yards excavation | 4,800 |
| Total cubic yards dredging | 2,060 |
| Total oak timber in foundations (ft. B.M.) | 127,492 |
| Total pine timber in foundations (ft. B.M.) | 96,452 |
| Total protection timber (temporary) " | 34,536 |
| Total lineal ft. protection piles (tempor'y) | 3.353 |
| Total lineal ft. protection piles (perman't) | 7,306 |
| Total lineal ft. protection timber (ft. B.M.) | 22,802 |
| Total bolts and clamps (pounds) | 46,710 |

The total cost of the bridge, including substructure, superstructure, approaches and operating machinery complete, was $96,743.

The work was executed by the following named contractors: Substructure, Fisher & Fisher, Cleveland, Ohio; superstructure, W. H. Pratt, receiver of Mt. Vernon Bridge company, Mt. Vernon, Ohio; electrical and compressed air equipment, including safety gates, G. P. Nichols & Bro., Chicago. The bridge was designed under the immediate personal supervision of Walter P. Rice, M. Am. Soc. C. E., chief engineer, and James T. Pardee, Assoc. M. Am. Soc. C. E., city bridge engineer, who was placed in charge of the work. Valuable services were also rendered by W. M. Hughes, M. Am. Soc. C. E., of Chicago, as consulting engineer. It is worthy of note that the electrical equipment, installed under the personal supervision of S. F. Nichols, has worked without a hitch from the moment the current was first turned on.

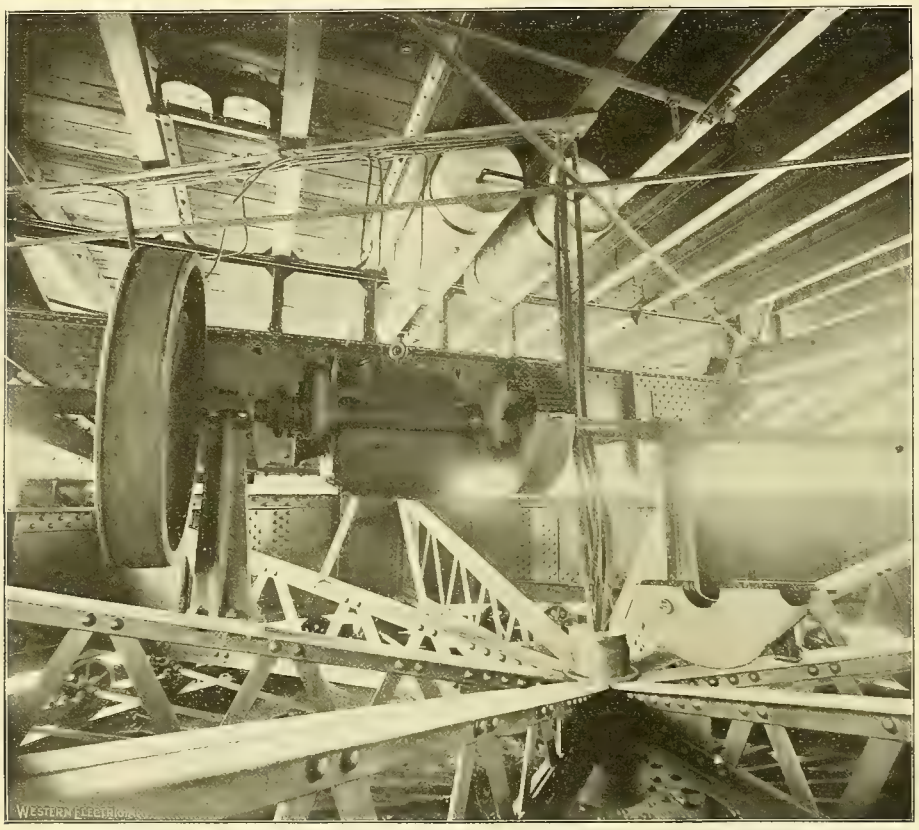


FIG. 2. DOUBLE SWING BRIDGE OPERATED BY ELECTRICAL POWER.—OPERATING MECHANISM UNDER BRIDGE.

## The Choice of Transformers.[1]

By D. C. Jackson.

The public data which are available for forming an opinion of the comparative economy of transformers are very meager. The little which is obtainable is to be found in a great measure in the advertising circulars of manufacturers, and while these results, being tests of their own and of rival makes, are often entirely reliable, such *ex parte* data are unsatisfactory to a careful purchaser. In order to place before you independent data representing all the American transformers of moderate capacities, I will give the results of a long and carefully carried out series of tests made by A. H. Ford in the laboratory of the University of Wisconsin. For these tests transformers of 1,500 watts capacity, as nearly as possible, were procured directly from the manufacturers within about a year from this date, so that the tests may be presumed to represent the latest and best designs which are now supplied. These transformers are from the most prominent makers and in fact include all important makes of American transformers with two or three exceptions.

The results of the tests are given in the attached table.

| Number. | Watts capacity. | Open circuit current. F=125 | Open circuit current. F=60 | Watts (iron) loss. F=125 | Watts (iron) loss. F=60 | Watts (copper) loss at full load. | Total pressure drop. | Efficiencies at full load. F=125 | Efficiencies at full load. F=60 | All day efficiency. F=125 | All day efficiency. F=60 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1250 | .043 | .066 | 37 | 48 | 30 | 2.5 | 95 | 94 | 85 | 83 |
| 2 | 1500 | .076 | .124 | 50 | 71 | 45 | 3.5 | 95 | 94 | 85 | 81 |
| 3 | 1500 | .052 | .100 | 32 | 46 | 38 | 4.0 | 96 | 95 | 89 | 85 |
| 4 | 2500 | .230 | .540 | 135 | 230 | 44 | 2.5 | 92 | 89 | 77 | 63 |
| 5 | 1800 | .076 | .600 | 53 | 109 | 67 | 5.0 | 94 | 92 | 85 | 75 |
| 6 | 2000 | .055 | .091 | 42 | 56 | 55 | 5.0 | 95 | 94 | 89 | 86 |
| 7 | 1000 | .028 | .064 | 24 | 28 | 33 | 3.0 | 95 | 94 | 87 | 86 |
| 8 | 1500 | .073 | .113 | 57 | 76 | 31 | 2.5 | 94 | 93 | 83 | 79 |
| 9 | 1500 | .077 | .144 | 43 | 55 | 28 | 3.0 | 95 | 95 | 86 | 84 |

These results, I find, do not differ very widely from those published by the Fort Wayne Electric corporation in a small blue-printed pamphlet which, however, contains tests made by the company upon only a few of the makes of transformers included in my table.

The data for each transformer are given for tests upon two frequencies, 125 and 60 periods per second respectively. Efficiencies have been calculated and are given in the table for each transformer when operated upon each frequency continuously at full load, and also when operated at an assumed load which may be taken as an approximation to the average load found on good stations operating 24 hours. The latter are called "all day" efficiencies and are calculated as though the transformers ran 19 hours out of the 24 on no load and five hours on full load.

A comparison of the losses of the different transformers and their efficiencies shows in most cases that the transformers with the smallest iron losses give the highest "all day" efficiencies. The effect of the iron loss on the working efficiency depends upon the length of time the plant runs. The waste of power due to the iron loss in the transformer continues as long as current is fed to the primary circuit, consequently a plant which only runs six hours per day will only waste one-quarter of the power by the iron loss of its transformer that it would if operated 24 hours per day. The actual number of watt hours used by the customers of the plant might not differ very greatly in the two cases, yet the output of the station when run 24 hours might be much greater than when run six, the difference being due to the difference in the amount of power wasted in the transformers. It is therefore evident that extreme care in the selection of the best transformers to be used on an alternating plant which runs all day may be of the greatest advantage. The lower the frequency of the alternating current which is used the greater are the returns coming from this care likely to be.

Let us compare transformers Nos. 3 and 4 as given in the table. These are both made by well known manufacturers. The copper losses at full load do not differ very much, what difference there is being in favor of No. 4. At average loads there would be considerably less difference in these two points.

The iron losses, which go on regardless of the load as long as current flows in the primary winding, differ very greatly even if we take three-fifths of the loss in number four as the losses of a 1,500 watt transformer of that type. Let us suppose that these transformers are placed on a plant which supplies current 24 hours each week day and 12 hours on Sunday, which makes a total of 8,136 hours per year that current would flow in the primary winding of the transformers, and the total number of watt hours wasted by the two transformers is shown below.

| | F=125 | F=60 |
|---|---|---|
| Transformer No. 3 | 8,136×32=252,000 | 8,136×46=374,300 |
| Transformer No. 4 | 8,136×80=651,000 | 8,136×140=1,140,000 |

In a station which turns out a kilowatt hour for each eight pounds of coal burned (and this in Wisconsin requires the station to be well arranged, and the use of coal that costs $2.50 or more) transformer No. 4 requires the buying of about a ton and a half of extra coal every year when operated at a frequency of 125; therefore it costs, other things being equal, upwards of $4 per year more to operate than No. 3. It would therefore pay well, if other things were equal, to buy transformer No. 3, even if its first cost were many dollars greater than that of No. 4. The difference between the transformers is even greater when the frequency is 60.

For every hundred transformers of the types here compared, the generator plant that supplies current to No. 4 must be of five kilowatts greater capacity than that required for No. 3, which means an increase of 3 per cent in the generating plant; that is, a plant of a given size which uses transformer No. 4 must have a capacity for supplying current greater by 3 per cent. than if transformer No. 3 were used.

The difference between these two transformers is largely due to differences in the relative amounts and arrangement of the iron and copper in the cores and windings, and the magnetic quality of the iron core. The standing of the manufacturers renders it probable that the transformers are of equal durability and reliability, but the regulation of No. 4 is better. The regulation question, which should be carefully considered, makes a serious deduction from the claims of No. 3 to first place in the comparison.

Differences sometimes occur between transformers of the same size and same make which are not as great as the differences here shown to exist between Nos. 3 and 4, but are sufficiently great to seriously affect their economy. In order to husband the capacity of a plant and to save in operating expenses, it is therefore of importance not only to test transformers of different makes which are presented for sale, but to test each transformer which is put on the line. This may be easily and expeditiously done. To test the iron losses the secondary coil of a transformer should be connected to the regular lighting circuits, with an ordinary wattmeter included, and the circuit of the primary coil should be left open. The reading of the wattmeter shows the number of watts which are wasted by the iron loss.

A wattmeter such as is required for these measurements costs from $40 to $70, and is an intrument that, like the steam engine indicator, pays to have at hand for proper use. However, if the regular wattmeter is too expensive to buy, an ordinary Thomson recording wattmeter, provided a sufficiently sensitive and reliable one is at hand, may be used in place of it, and the record reduced to the basis of one hour. It is needless to say that instruments which are used in such tests as are here proposed must be fairly reliable.

To test the copper losses in a transformer the quickest and easiest method, which is approximately accurate, is to connect the primary coil of the transformer in series with some resistance (iron wire or lamp) to the alternating incandescent circuit, and short-circuit the secondary coil of the transformer through an amperemeter. The resistance should be adjusted until the full load current of the transformer flows through the amperemeter. The reading of a wattmeter so connected in circuit with the primary coil gives the copper loss approximately.

1. Read before the Northwestern Electrical association, Chicago, July 19, 1895.

The drop in pressure in a transformer may be measured by connecting the transformer to the lighting circuits and reading the primary and secondary pressures by voltmeter. The transformer may then be loaded by lamps and the pressures again read, when the drop is at once seen. One voltmeter may be used for this, but two are more convenient.

For the testing of individual transformers as they are delivered and before they are put on the lines, all the instruments which are required are already in the possession of the electric station, with the exception of a wattmeter and this is not a serious deficiency since, if necessary, a Thomson recording wattmeter may be used instead. The testing need take but little time and is likely to result, in average stations, in the saving of considerable wastes.

Proper records of his transformer tests enable a station manager to determine at once the amount of saving that he may make by replacing certain small transformers by one large transformer. If tests are not made, such changes may not bring the results expected, since a number of first-rate small transformers may be replaced to no advantage by a large transformer if the latter is not a good one; but usually a large transformer, if one of the best, is more desirable than several small ones, whether they are good or bad.

For your guidance in selecting transformers, I will give you the following data, contained in a table made out by Professor Ryan. The table gives the largest currents which should flow in the 1,000 volt primary of good transformers when the secondary circuits are open:

| Watts capacity. | Leakage current. |
|---|---|
| 1,000 | .055 |
| 2,000 | .080 |
| 6,500 | .100 |
| 17,500 | .200 |

When the low pressure coil is connected to a 100 volt circuit the leakage currents may be expected to be 10 times as great.

For intermediate capacities, intermediate values of the open circuit or leakage current may be expected. I shall add to this the values of the iron loss, which should not be exceeded in thoroughly good transformers.

| Watts capacity. | Iron loss. |
|---|---|
| 1,000 | 30 |
| 1,500 | 40 |
| 2,000 | 50 |
| 2,500 | 60 |
| 4,000 | 80 |
| 6,500 | 100 |
| 17,500 | 150 |

The copper losses in transformers of all sizes should never exceed 3½ per cent. at full load, and ought to be between 1½ and 2½ per cent. The total drop in secondary pressure, due to loading a transformer, if the primary pressure is kept constant, ought not to exceed 3½ per cent.

## Notes on the Reconstruction of a Small Central Station Plant.[1]

By Franklin L. Pope.

The financial condition of the smaller central station electric lighting plants throughout the country is at the present time by no means satisfactory, and in too many instances cannot even be truthfully said to be encouraging. A survey of the field shows that very few such plants located in towns having less than 10,000 inhabitants are earning more money than is necessary to meet their operating expenses and to provide for indispensable current repairs. In the state of Massachusetts, in which the operations of all electric lighting companies are by law made a matter of public record, it appears from the latest reports that the aggregate liabilities of the 57 companies operating in that state, including stocks, bonds and floating indebtedness, amounted on June 30, 1894, in round numbers to $14,000,000, nearly all of which stands charged to construction account. The net earnings for the preceding year were $1,000,000, or about 7.1 per cent. on the total investment—a sum obviously quite insufficient to provide for depreciation, and at the same time pay a fair dividend on the capital which has gone into the business. But if half a dozen of the larger plants, in cities like Boston, Lowell, Worcester, Springfield, Lynn and Fall River, were excluded from the list, the showing for the smaller plants would be even far worse than it now appears.

Many of these small plants were started at an earlier day than could have been justified by any reasonable estimate of the business then in sight, and now find themselves hampered by inconvenient buildings, and with unsuitable machinery bought at high prices, and encumbered with defective business methods which experience has shown to be wholly inconsistent with the dictates of good judgment.

With the owners of many of these plants it has become a very serious question whether the easiest way out of the dilemma which confronts them may not be to relegate the entire plant to the junk-shop and the scrap-pile, and commence over again with new buildings, modern machinery and improved methods of administration. When the necessary capital is readily forthcoming there can be no doubt that this would often be the wisest course of procedure, but for obvious reasons it is one which is not always, nor even usually, practicable. The alternative is to remodel the existing plant, bringing it as nearly as may be into accordance with the best modern practice, and utilizing so far as possible the old material—a course which at least has the merit of avoiding an undue expansion of the construction account; in most cases already sufficiently burdensome.

Having been called upon during the last year to advise the owners of a plant of the character referred to, in reference to certain changes which had been suggested as desirable, and having afterwards been employed in a professional capacity to design the work and superintend its execution, I have thought that some account of what we undertook to do and how we did it might not be without interest to the members of the Institute.

The Great Barrington, Mass., Electric Light company was organized and commenced business in 1888. The population of the district intended to be served was about 3,000, and most of the expected consumers were located within 2,000 feet of the point decided upon for the station. This was built of wood in the most inexpensive manner possible, and was placed alongside the railroad for convenience in receiving coal, although at the same time the danger from fire was materially increased. The original outfit was an Edison three-wire, equipped with a pair of 250 light 110 volt dynamos, and the company commenced business with 281 lights on contract at $10 per year each, wiring free. The center of distribution was 1,800 feet from the station, necessitating over a ton of copper in the feeders alone. Generally speaking, the plant was well laid out and well built as things went in those days. The two dynamos were belted to a single 80 horse power Armington & Sims engine. The original cost of the plant was about $16,000. The following year a Schuyler arc plant for street lighting was added, carrying 35 arcs, nominally of 1,500 candle power, which was run from the same engine and boiler. In 1890 the plant was considerably enlarged by the addition of a second arc machine, a Westinghouse 500 light alternator and a second engine and boiler of the same capacity as the first. An 80 kilowatt Westinghouse dynamo of more modern type was afterwards substituted for the original one.

Upon examining the plant last year, I found the Edison machines carrying on Saturday evenings a maximum load of some 450 lights, while three evenings in the week (with the stores closed) it fell to perhaps half that amount. The two Schuyler machines, with an aggregate capacity of 55 to 60 lights were carrying about 38 to 40 or an equivalent of that amount, while the Westinghouse machine was seldom as much as half loaded, carrying a maximum of possibly 500 lights during three or four months of the summer season, and not much more than one-fourth that amount the remainder of the year. Necessarily, with so many dynamos of different types, and with such a variable, yet small average output, the consumption of coal was excessive as compared with the light delivered and paid for.

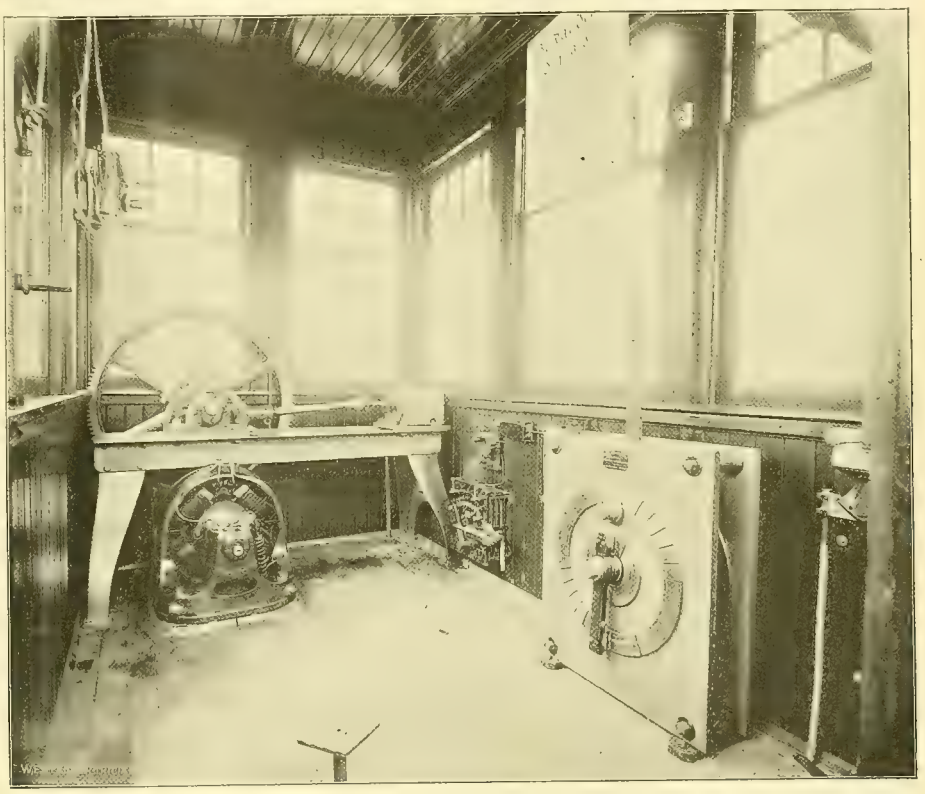


FIG. 3. DOUBLE SWING BRIDGE OPERATED BY ELECTRICAL POWER.—INTERIOR OF SOUTH OPERATING HOUSE.

The street lines, according to the usual practice, were of No. 6 B. & S. weatherproof wire; the poles were of cedar, of good size and fitted with pine or spruce cross-arms, with common green glass insulators set upon wooden pins. In consequence of a silly prejudice, which had been fomented amongst the citizens by interested parties against permitting poles to be set in the streets, the wires, in a very great number of instances, had been attached by cross-arms or brackets, to the trunks of the immense elm trees with which the streets of the town were shaded, a practice which occasioned an enormous loss of current every wet night as well as much irregularity in the performance of the lights. The effect on the trees was by no means salutary, while the appearance was as much worse than that of poles in the streets as could possibly be imagined.

The village of Great Barrington extends for the most part along a single broad thoroughfare for a distance of nearly three miles, and the street-lighting circuits are consequently very straggling. The 1,500 candle power lamps, which were suspended at intervals of 800 to 1,000 feet, were actually of very little service in illuminating the densely shaded streets.

After a careful consideration of the situation, keeping in view the greatest possible reduction of present and future operating expenses, it was determined that the wisest course to pursue would be to consolidate the whole service so that it could be supplied by one dynamo, in place of five underloaded ones. In pursuance of this plan it was decided to adopt the two-phase alternating system, at a maximum pressure of 2,100 volts in the primaries and 105 volts in the secondaries, with a frequency sufficiently low to permit the advantageous use of induction motors if required. It was furthermore decided to abandon the steam plant and to make arrangements to utilize some one of the excellent water powers which were available within practicable distances. Under ordinary circumstances I should have hesitated to recommend the substitution of water power for steam as the sole source of power for the operation of an electric lighting plant. Water power is an invaluable auxiliary, and when conveniently available for use in conjunction with steam may often be made to save a very large coal bill in the course of a year. On the other hand the excessive fluctuations to which it is subject—which are scarcely realized by those but casually acquainted with the subject—render it in most cases a very uncertain reliance for a business which is compelled to go on, perforce, every night in the year, and which cannot suspend operations, as an ordinary manufactory does, if worst comes to worst, for a week or two at a time. Even a water privilege which, during ten months of the year, furnishes twice as much power as is needed, and even more, may be expected to fall off during one of the extraordinarily dry seasons which occur at intervals of from five to ten years to one-third its usual amount. In such a case an electric plant solely dependent upon water power would find itself in a most undesirable predicament.

In the present instance the choice of a water privilege finally reduced itself to two sites, one in the town itself, within half a mile of the center of consumption and the other at Glendale village, seven miles distant, both situated on the Housatonic river. The privilege first mentioned being already occupied by a woolen factory, only the surplus water was available, but this was known to be quite sufficient for the requirements of the electric company at least nine months in each year, leaving three months to be run by steam. It had the advantage of being close at hand and was capable of being fitted up at a moderate cost. As to the Glendale privilege, it was necessary to be very sure that the lowest water of a dry summer would give all the power required to run the plant without the aid of steam. Having invariably found the value of a water power to be greatly exaggerated, not only in popular estimation, but in the opinion of its owners, the matter was investigated with much care. From the official state map of Massachusetts it was ascertained that the area of the drainage basin of the Housatonic above the Glendale dam was 269 square miles. J. T. Fanning, a leading authority, from an extended examination of the recorded observation on the rainfall and flow of the New England rivers, reaches the conclusion that a water-shed of the area mentioned may be estimated to yield the quantities of water given below:

*Cubic Feet of Water per Second per Square Mile.*

Minimum (15 days of least summer flow).... 0.25
Mean (120 days, usually July to Oct. inclusive) 0.90
Maximum (flood volume).....93.00

It will be noticed that the flow in extreme dry weather is less than one-third of that which may be depended upon through the remainder of the year.

The distribution of rainfall throughout the year should be studied. It is often materially modified by local geographical conditions. The diagram shows that the distribution on the head-waters of the Housatonic is quite different from the normal type of the northeastern region. The same may be true of other rivers.

While this investigation was going on, it was discovered

1 Read at the twelfth general meeting of the American Institute of Electrical Engineers, Niagara Falls, June 27, 1895.

that accurate measurements of the volume of water in the Housatonic river had been made in 1878 by the engineers of the New York Department of Public Works, with reference to its utilization as a source of water supply for that city. The minimum summer flow was found to be (as given in the engineer's report), 0.34 cubic feet per second per square mile. It was also learned that measurements made on several different occasions at Birmingham, Conn., in very low stages of water, gave an average of 0.32 cubic feet per second per square mile. It was therefore assumed that Mr. Fanning's estimates were at least on the safe side. The greater volume of water found by the actual measurements, is doubtless due to the fact that there are some five or six square miles of reservoirs, consisting of natural and artificial lakes, on the upper waters of the Housatonic, which are drawn upon by the numerous mills on the river as an extra supply during the season of drought.

A minimum flow of 0.25 per second per square mile would give at Glendale 4,035 cubic feet per minute. Multiplying this by the weight of a cubic foot of water, 63.3 pounds, gives 255,415 foot-pounds, which, divided by 33,000, gives 7.74 gross horse power per foot of fall, or a total of 99.6 horse power for the 13 feet fall at Glendale. The average efficiency of a good turbine may safely be taken at 75 per cent., which would give 67.9 as the available horse power during the whole 24 hours, in time of lowest water. In electric lighting, however, the great bulk of work is done within a period of about four hours (in summer time) and hence it is possible, in case there is sufficient area of pondage above the dam, to increase this capacity by storage at least four-fold, which would raise the limit of minimum available power during lighting hours to 271.6 horse power —an amount which was considered to be ample to meet all the probable requirements of the Great Barrington plant for many years to come.

While negotiations were still pending with the owners of the Glendale privilege, and also the one in the village already referred to, overtures were received from a manufacturing company owning a third exceptionally desirable privilege, on the same stream, at an intermediate point considerably nearer than Glendale. This company had only recently completed a new dam, head-gates, raceways, etc., at a very considerable expense, and was willing to lease the complete establishment, including a new McCormick turbine of 325 horse power and a two-phase Stanley generator of corresponding capacity, at a monthly rental, based upon the actual output as measured in kilowatt hours at the dynamo terminals, provided that a certain minimum monthly consumption was guaranteed. With the same volume of water as at Glendale, the fall at this point was 20 feet, assuring at least 417 horse power at lowest water during lighting hours. All the the hydraulic apparatus and appointments were of the best possible construction, and well calculated to insure absolute permanency of operation.

The minimum rental required was somewhat less than the amount of the coal-bill of the Great Barrington company for the preceding fiscal year, but while the immediate saving in operating expenses was not large, the acceptance of the proposition would place the company in a position to reduce its rates to consumers, for the reason that its output might be very largely increased without materially augmenting its operating expenses. A lease for a term of years was accordingly closed.

In laying out the plant it was determined to bring the main feeders directly to a distributing station in the village, to be used principally as a convenient headquarters for testing the circuits and controlling the street-lighting service. In laying out the transmission line, a surveyor was employed and a preliminary line was run directly from the power-house to the distributing station. The air-line distance was found to be 5.15 miles. With the assistance of the surveyor, the actual line was then staked out, going directly across country, and keeping as near as circumstances permitted to the transit line. About half the distance, the transit-line was found to so nearly coincide with existing highways that the consent of the local authorities was obtained to set the poles along the highway location; the remainder of the route lay principally through uncultivated land of little value, so that a comparatively small expenditure was sufficient to secure a release from all claims for land damages. This enabled the line to be located with long stretches absolutely straight, avoiding all sharp angles—a very important consideration when heavy wires are used. The poles were of selected chestnut with natural butts, usually set five feet in the ground at maximum intervals of 125 feet. The poles are ordinarily 25 feet long and eight inches thick at the small end. Shorter poles were sometimes used on elevations and longer ones in depressions, in order to equalize the strain as much as possible. The insulators used were of the large double-bell white porcelain type (German government standard), and were imported by us from Berlin. The insulator of the top wire is set upon a malleable iron stem 14 inches long screwed into the top of the pole which is tapered to five inches diameter and protected from splitting by driving on a wrought-iron ring. The tapered part of the pole, as well as the top, was given a coating of mineral paint mixed as thick as it could be spread with a brush. The insulator of the second wire is carried on a malleable iron goose-neck, screwed into a five-eighth inch hole bored in the side of the pole, in such position as to bring the wires about 16 inches apart. Another hole was bored on the opposite side of the pole, intended to take the goose-neck of the third wire at some future time, leaving the same interval between the second and third wires. The porcelain insulators are fixed to their iron supports by a packing of oakum placed between the screw-threads, which serves to prevent any danger of breakage by expansion or contraction. The line wire is laid in a groove formed in the top of the insulator, except upon the curves and angles, in which case it is tied at the side in a circumferential groove, as is usual in this country. The German method of tying is quite complex, and unnecessarily strong; in case of undue strain, if anything gives way it had best be the tie-wire. We therefore devised a simple tie which was easily and quickly applied, and which has so far served an admirable purpose. We were obliged to string the wires during very cold weather; sometimes as cold as eight or ten degrees below zero, and hence it was necessary to strain them very tight. A block and fall and a well-trained horse were used in pulling up, usually six or seven spans of one wire at a time. The hook of the block was always attached to the copper wire, whether bare or insulated, with a chain knot made of three-quarter inch rope. The feeder wires were of No. 3 B. & S. soft copper, covered with weatherproof "insulation" along the highway (as a concession to enlightened public opinion), but elsewhere bare. The lengths of wire were joined with McIntyre twisted

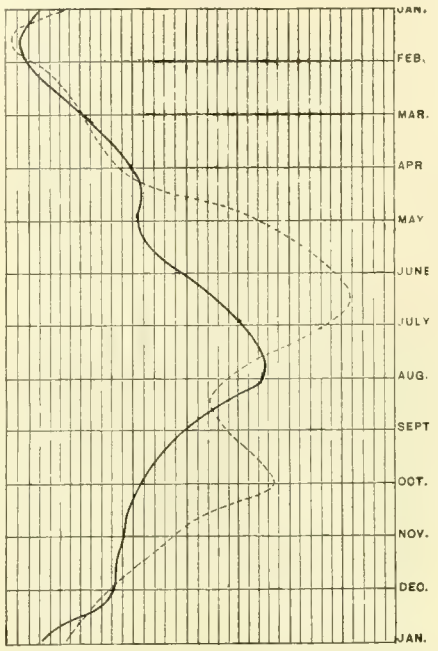



FIG. 1. NOTES ON THE RECONSTRUCTION OF A SMALL CENTRAL STATION PLANT.—CURVE OF MEAN ANNUAL DISTRIBUTION OF RAINFALL. FULL LINE IS REDUCED OBSERVATIONS AT WILLIAMSTOWN, MASS., 1816 TO 1874. DOTTED LINE IS MEAN OF ALL OBSERVATIONS IN THE HUDSON AND CHAMPLAIN VALLEYS, AND NORTHERN AND WESTERN NEW YORK, AGGREGATE 564 MILES.

couplings; the unusual strain we had to put upon them occasionally pulled one apart, and this led us, out of abundant caution, to solder them, although this was done for mechanical rather than for electrical reasons. Only two feeder wires have as yet been strung, providing for a single-phase current from one side of the two-phase generator, but it is the intention to run a third feeder hereafter, which will enable two-phase induction motors to be connected to the same distributing system.

A pair of telephone wires of No. 12 steel were strung below the feeder wires, and these were supported upon small German porcelain insulators on iron goose-necks on opposite sides of the poles. These wires were transposed at intervals of about a mile, in order to eliminate the inductive effects of the alternating current in the feeders. The feeder

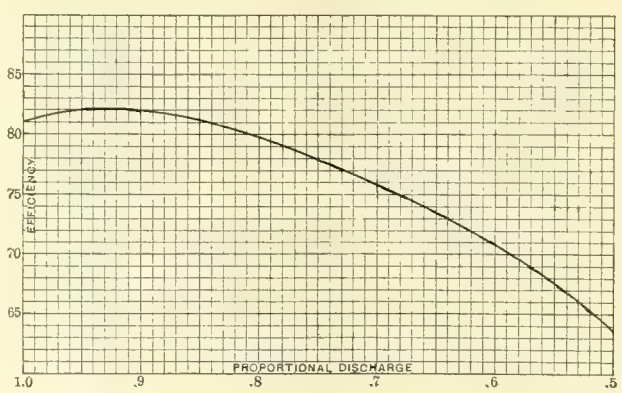



FIG. 2. NOTES ON THE RECONSTRUCTION OF A SMALL CENTRAL STATION PLANT.—EFFICIENCY TEST OF M'CORMICK'S TURBINE.

lines were carried under the railroad at an undergrade crossing by placing the insulators upon iron brackets leaded into the stone abutments. The plan of construction above described makes a strong, handsome and durable line, while the insulation of the circuit, even in the worst of weather, is simply faultless.[1]

The system has been planned to deliver the current at the distributing station at a uniform pressure of 2,100 volts. Two distributing centers were fixed upon in the old Edison three-wire network, and at each of these points a pair of large transformers, having a ratio of 20 : 1, were fixed upon a pole, with their respective primaries in series between a pair of branch feeders from the distributing system, and their secondaries were coupled in series in like manner with the neutral wire between them. None of the consumers on the old Edison system knew when the change had been made to the new service from anything they were able to notice in the behavior of the lights.

The next thing done was to reconstruct the street lighting system. In place of the 36 arcs of 1,500 nominal candle power formerly in use we substituted 126 incandescent lamps of 50 volts and 32 candle power, placed in Iona fixtures projecting horizontally from the poles 14 feet above the ground. The lights, as a rule, were fixed upon every alternate pole, but in the business center, the street being broad, they were placed on each side at intervals of about 250 feet, and staggered, so as not to come opposite each other. A Shallenberger shunt cut-out was applied to each lamp. The usual number of lamps in each circuit was 42, although we have since placed, in some cases, as many as 47 in one series without reducing the brilliancy of illumination sufficiently to be noticeable by any one but an expert. One end of each street-lighting circuit is joined to a special feeder leading to the sub-station, where it is connected with the main feeder through a knife-switch. The other end of each lamp circuit is connected to any conveniently located branch feeder of the regular commercial lighting service. Each lamp circuit has, or will have, a fuse-block and cut-out enclosed in a weatherproof box at each end, where it joins the opposite feeders. These 32 candle power lamps, when run at full candle power, furnish a most satisfactory illumination and give the streets a very attractive appearance. So far as possible, each lamp was located with the aid of a transit and level, so as to get them in absolutely straight lines both vertically and horizontally, a precaution which adds materially to the decorative effect. It is admitted by all that the streets of the town are much more satisfactorily lighted by the incandescents than formerly by the arc lamps, while the actual cost to the company is considerably less. The new lamps were cut in, one at a time, on the old arc wires, jumpers being temporarily placed across the terminals until everything was in readiness to discontinue the use of arc machines.

One of the most marked advantages of the series street-lighting system, especially when shunt cut-outs are used, is its great flexibility and convenience. For example, instead of placing from 40 to 45 50 volt lamps in one series, we may use 20 to 23 100 volt lamps, or if an odd number be required, less than is necessary to make up a circuit, the deficit may be supplied by adding extra shunt boxes in series at any convenient point in the circuit, until the pressure has been reduced to the required point. From time to time, as new lights are added, these spare shunt boxes are one after another brought into use in connection with them. Sometimes, also, we temporarily install extra street lights by connecting them in parallel to the secondary mains of the regular commercial service, ultimately transferring them to new series circuits.

It has been found to be desirable to use a lamp of rather low efficiency for the street lighting service, as there is always danger of leakage and short-circuits from wet boughs of trees and other objects getting into contact with the wires, and thus diverting an abnormal current through some portion of a lamp circuit. In such case, a lamp of high efficiency is pretty certain to be burned out, or at least to have its career of usefulness materially abridged. In this plant the average consumption of energy in the street lights, including lamps, lines, shunts and leakage, is found to be about 140 watts per lamp of 32 candle power.

Perhaps the most ticklish part of the whole undertaking was the changing over of the Westinghouse system, which was a 1,050 volt primary and a 52 volt secondary, running at 16,500 alternations. In accordance with the new plan, it was of course necessary to double the pressure both in the primary and secondary circuits, and to substitute 104 volt for 52 volt lamps throughout. A preliminary test of one of the transformers demonstrated that which perhaps might have been foreseen from theoretical considerations, viz.: that a dangerous quantity of heat was developed within a few hours when it was used to convert from 2,000 volts down to 100. In order to utilize, so far as possible, the old transformers, and at the same time avoid the above difficulty, various expedients were resorted to. Wherever a group of consumers was located in one neighborhood, a pair of large transformers was installed, with secondary mains extending from 500 to 600 feet in various directions; these transformers being of course placed in series with each other. Scattering consumers, as far as practicable, were connected together in small groups, and supplied by a pair of small transformers coupled in the same way. The Westinghouse meters, having been originally constructed for a frequency of 16,500 alternations, ran slow when the frequency was reduced to 8,000. The necessary coefficient for correction of the readings was easily ascertained by experiment, and as fast as possible the meters were fitted with new disks, supplied by the Westinghouse company at a trifling expense, and adapted to the lower frequency.

Of course it will be understood that the reason for resorting to these various shifts and expedients was merely that we might utilize the old apparatus as far as it

1. I regret that I am unable to present any actual measurements of the insulation of the line of the Great Barrington company, no opportunity having occurred since the work was completed of making tests under atmospheric conditions of minimum insulation. Several years ago, however, while engaged in telegraphic service, I made a series of nearly 100 separate tests in rainy and foggy weather, extending over a period of five years, of a set of 10 porcelain insulators of the same make and pattern in every particular as those now on the Great Barrington line, erected on a house-top in the city and therefore much exposed to smoke and dirt. These measurements gave a mean resistance of 28.3 megohms, and a minimum resistance of 19 megohms per insulator. On a metallic circuit, therefore, the minimum insulation resistance at each pole would be 38 megohms. On the Great Barrington line of 28,260 feet there are 250 poles and other supports, and hence we may assume that the minimum resistance of the insulation of the circuit as a whole would be 152,000 ohms. The current loss by leakage is found by dividing the mean voltage by the insulation resistance; $\frac{2,200}{152,000}$ = 0.014 ampere; an amount too small for serious consideration.

could possibly be done, and also that we might carry on the work of reconstruction, for the most part, with the ordinary working force of the establishment.

The horizontal double turbine which is used to drive the two-phase generator has done such good work that it deserves a few words of commendation. The selection of the best among the many available types of turbines for electric work is a matter which merits far more consideration from a scientific standpoint than it generally receives. Water-wheels, like dynamos and motors, are sometimes sold on commission by agents, and it not infrequently happens that the salesman who makes the largest "claims," especially if he sells his goods the cheapest, carries away the contract. It needs to be said, however, that there is a far greater difference than is often suspected in the amount of work different types of wheels will do with a given, and especially a limited, amount of water. There are, furthermore, a great many types of wheels in the market, which, although as efficient as could be asked for with a full volume of water, are very far from being so when the volume of water is reduced, even by a comparatively small percentage. It is but just to say that it is seldom that a turbine makes so favorable a showing, not only in this but in other respects, as the one provided by the company from which we lease our power. The following figures are selected from a much larger number obtained by actual measurement of its performance, in the testing flume of the Holyoke Water Power company:

| Head acting on wheel. feet. | Revolutions per minute. | Quantity of water passing through wheel (cu. ft per sec.) | Horse power. | Per cent of efficiency. |
|---|---|---|---|---|
| 16.06 | 156 25 | 81 75 | 124.50 | 80.09 |
| 16 80 | 154.00 | 79 | 109.37 | 81.18 |
| 17.02 | 154.50 | 63 42 | 95 86 | 78.59 |
| 17.26 | 156 75 | 52.19 | 73.42 | 71 95 |
| 17.44 | 152 25 | 42 55 | 53 71 | 03.90 |

These results are worthy of particular note, for the reason that they show a very high percentage of efficiency maintained through a wide range of variation in the quantity of water passing through the wheel—a most valuable characteristic for electric work. When the quantity of water used was diminished from 81.75 to 42.55 cubic feet per second, the percentage of efficiency fell only from 80.99 to 63.9, and what is even more remarkable, it was found that the efficiency remained well above 80 per cent. over a range of variation of discharge from 83.22 to 70 cubic feet per second or 15.9 per cent. More than one type of turbine which enjoys a high reputation and extensive sale among manufacturers will not reach 65 or even 60 per cent. efficiency at "three-quarters gate," while the 33 inch wheel above referred to has been found to give, by actual test, 78 per cent. under similar conditions.

The turbine carries upon its shaft, a driving-pulley 100 inches in diameter, weighing 11,000 pounds, which serves as a balance-wheel. It is also provided with a Replogle electric governor operated by three cells of gravity battery, which has never failed to do its work quickly and certainly, even under trying conditions.

In carrying out this work, some things have been learned by experience which may be of use to others called upon to advise or to undertake the construction of similar works, and I will therefore venture to summarize some of my conclusions as follows:

1. In considering the advisability of operating an electric plant by water power, do not on any account neglect to ascertain from authentic sources of information just how much water can be depended upon during the low stage in an extra dry year for this is the measure of its value for electric work, except when used as an auxiliary to steam. The ordinary estimates of the commercial value of a water-power are only too apt to prove preposterous exaggerations.

2. If rights-of-way or releases of damages can be obtained without too much trouble and expense, it is better to build the feeder line as directly across country as may be, than to follow a highway. The saving in cost of construction will usually be more than enough to pay for the right-of-way, and on such a route there need be no interference from trees, while many inconvenient angles and much trouble in guying and bracing are avoided. Shorter and stouter poles may also be used; in itself a very important consideration.

3. In electric line construction it is preferable to dispense with cross-arms unless there are more than six wires. The best arrangement is to place one wire on a top-pin and the others alternately on the front and back of the pole, at a vertical distance apart of 12 inches. This construction not only costs less than properly braced cross-arms, but is much less conspicuous and therefore much less objectionable in a public street; is less interfered with by trees, and is far more durable. Much trouble is caused by the decay of cross-arms after they have been exposed a few years to the weather; they split at the ends so that the pins come out, and not infrequently break in the middle, thus fouling the wires.

4. In medium-sized towns and cities, especially in shaded streets, the incandescent lamp may be made to give a far better distribution of light for the same money than is possible with the "half-arcs" so extensively used, and is much less troublesome to maintain in good working order. My own experience leads me to think that the lamps ought not to be of less than 24 or more than 32 candle-power. Use lamps of low rather than high efficiency, but run them at full candle power, or even a trifle above. Good street-lights, well arranged, and renewed sufficiently often, are the best possible advertisement for any electric company.

5. Use large transformers as far as practicable, placing the consumers within 500 or 600 feet radius upon secondary mains. We have used both two-wire and three-wire mains. The latter plan is certainly to be recommended when the distance approximates or exceeds 500 feet, but for short distances, as, for example, when distributing within a single block at a pressure of 100 volts or more, it is a question whether the gain in cost of copper over the two-wire plant is of sufficient importance to offset the additional complexity.

6. It was found that raising the voltage in the residence district from 1,000 : 50 to 2,000 : 100 greatly improved the uniformity of distribution by lessening the potential drop without entailing any corresponding disadvantages. It would seem to be preferable, on every account, to use the higher pressure.

7. One of the most important minor points in the management of a plant is apt to be too much neglected—the maintenance of the insulation of the wires by promptly replacing all cracked and broken insulators, and by keeping the wires absolutely free from contact with uninsulated objects. The covered wires which lead into the hoods of the street-lamps need to be carefully looked after.

8. Number all the poles with yellow paint applied with a stencil on a black ground, and keep a record book of the position of each one and its distance by the line from the test-station.

9. In selecting a turbine wheel, consult competent authorities as to the available fall and minimum quantity of water, and when making the purchase do not expect to get a thousand-dollar wheel for a hundred dollars. Pay a fair price and insist not only that the wheel shall be well made in every way, but that it shall be tested by an expert before acceptance. If it does not give an average efficiency of 76 per cent. between half-gate and full gate, it is not advisable to accept it, inasmuch as you can easily do better, as our own experience proves.

10. I think our experience shows that it is possible to largely increase the net earnings of an old plant without necessarily refitting it throughout, but plenty of time should be taken for consideration as well as for execution, in order to secure satisfactory results with a moderate expenditure.

## Old-time Telegraphers.

This year will be an eventful one for many of the old-timers among telegraph operators of the country. New York will be the scene of the convention, and a right royal reception and entertainment is being arranged by the representatives of the local electrical fraternity. Invitations have already been issued, and if the character of the entertainment is foreshadowed by the cards it will certainly be a most gorgeous affair.

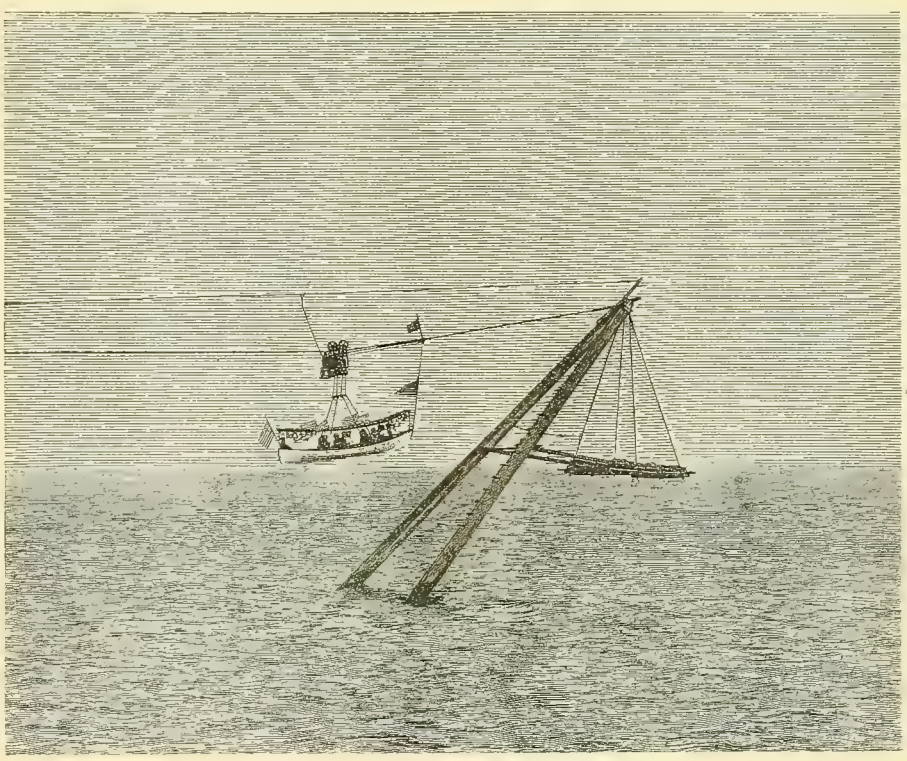
Business meetings will be held on the first day, September 11th, that of the Old-time Telegraphers & Historical association being set for 10 A. M., while the United States Military Telegraphers corps will be called to order at 2 P. M. At eight o'clock in the evening a special entertainment will be given at Chickering Hall. The following day there will be an ocean excursion to Long Branch, where a banquet will be served. The next day will be devoted to sight-seeing in the city and vicinity.

## Cutter Company Fails.

Announcement is made of the assignment of the Cutter Electrical & Manufacturing company of Philadelphia. Henry B. Cutter, president of the company, has issued a notice saying that a statement of the affairs of the concern is being prepared, and that a meeting of creditors will be called at an early day to consider the affairs of the company.

## Electrically Operated Seaside Attraction.

One of this year's attractions at Coney Island is a suspended boat or car which travels from the shore out over the waves on a cable, the power being supplied from a trolley wire to an electric motor. The supporting cable is 1¾ inches in diameter and 825 feet long. It is attached at its outer or seaward end to the apex of a pair of anchored shears, inclined outward at an angle of about 90 degrees, as shown in the picture, the timbers of the shears being each 104 feet long. The tops of the shears are from 60 to 65 feet above the surface of the water, according to the state of the tide, and to help to counteract the strain of the cable upon them a weight of five tons, consisting of bags of sand, is suspended upon a platform from their highest point. At the land end the cable passes over bearings of a corresponding height and is made fast around piles in the rear of the trolley house. The motor, suspended in a frame close to the pulleys by which it is supported from the cable, weighs 1,200 pounds, the frame also carrying the operator, and the current being received through a small contact wheel traveling upon a separate conductor. It is a ten horse power motor, the current being supplied from a dynamo run by an engine in a rear building. A friction brake and gear upon a shaft connected with the motor allows the operator to raise and lower the boat at will, with any load which the boat may happen to have on.



ELECTRICALLY OPERATED SEASIDE ATTRACTION.

The traction upon the cable of the pulleys from which the motor car is suspended is at all times effective, from one end of the cable to the other, and the motion is steady and even, although in going up the steeper inclines, as the car approaches either end, the motion is slower. The motor car itself, however, was used to carry out the five tons of counterweight used on the suspended platform, the car traveling to the very apex of the shears, and the platform being 30 feet beyond the shears, at the point where the weight was deposited. In the regular trips of the trolley the boat is carried at a height which will just escape touching the tops of the breakers, for a high roller might otherwise prove uncomfortable to the passengers, and a pause of a few minutes is made at the outer terminus, to give the occupants of the boat a view of the sea and shore from their vantage point. The engraving is reproduced from the *Scientific American*.

A bitter feeling has been engendered in the town of Harvey—a Chicago suburb—by the agitation of the liquor question. The electric light plant belongs to the Harvey Land association and is located at West Harvey, about a mile and a half from the city of Harvey proper. During the forenoon of August 6th the chief engineer was notified that it would be well to keep a close watch on the engine room. This was done and before it was time to start the engine that furnishes the power for the dynamos an investigation was made. Quantities of emery were found in the bearings of the machinery sufficient to have rendered the apparatus useless in a very short time. In each journal of the incandescent dynamo and the engine a thimbleful of the emery had been placed and a like quantity was found in the oil cups of the arc light dynamo. The miscreants were not apprehended.

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CIRCULATION, 16,630.

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AFTER prolonged silence on the subject of its plans, information comes from Boston to the effect that the Standard Telephone company has started work upon its system. The first lines to be built will be from New York to Washington and New York to Chicago. No securities have yet been issued, it is announced. The New England representative of the company says the people behind it understand what a tremendous undertaking they have on their hands, but there is capital enough behind it to make the chances of success good. The appearance of this company in the field at this critical point will no doubt tend to encourage other enterprises. Such a powerful organization as the Standard company is represented to be should contribute largely to the defense of anti-Bell companies, against which test cases have been or will be commenced. No better time could be selected for showing the power and willingness of this company to fight the old concern.

ANY large city desiring the services of a reformer may secure one with several years' experience by applying to Mayor Pingree of Detroit. While in New York last week this eminent reformer bewailed and bemoaned the fate that placed him in the comparatively obscure and inconsequential office of mayor of Detroit when there was such a field for his peculiar ability in New York. His greatest ambition seems to be to cripple public enterprises like street railway and lighting companies, corporations representing millions of invested capital and engaged in work from which the people at large receive numerous advantages. He is willing to enlist in the cause of reform wherever he can gain the most notoriety. He will not be satisfied with such public notice as Mayor Strong has been contented with. The latter's afternoon-teas at the city hall caused a little flurry in society and in politics, but Mayor Pingree's innovations would be most pronounced sensations. Here is a chance for Philadelphia and St. Louis. If Mayor Pingree's capacity equaled his assurance, he might arouse either of these cities, but it is scarcely to be hoped that such ambition is even his.

MILWAUKEE can be relied upon periodically to furnish an interesting story of controversy over some public enterprise. The good people of that town are constantly engaged in the task of starting new enterprises or endeavoring to restrict the powers and privileges of some existing corporation that may have incurred their displeasure. It will not surprise anyone to learn that the street railway problem is again occupying considerable prominence in the public mind. This time "Larry" McGann is the cause of all the turmoil and confusion. The ex-congressman seems to have temporarily shifted the scene of his operations from Chicago to Milwaukee, and the local street railway company, or rather what is left of it, is threatened with a formidable rival. Herr Payne will find in "Larry" McGann a foeman worthy of his steel. At the present time the newcomer is immensely popular. He has promised to introduce reduced fares, a comprehensive transfer system, and many other "reforms," improvements and advantages which the people of Milwaukee have been clamoring for but which the old company persistently refused to grant. It is not to be inferred that all the advantage is on the side of the new company. The knowledge possessed by Receiver Payne must not be passed over lightly, nor is his influence with the city government to be disregarded. There is no man in the West who has got so much for comparatively nothing as the Milwaukee colonel, and there is no evidence that his powers of attraction have in any way diminished.

AN interesting inquiry is now being conducted in the cities of New York by a legislative committee which is endeavoring to ascertain the cost of building and operating street railways. The committee has already completed its labors in Brooklyn and is now looking into the affairs of the Buffalo company. The movement was started by Alfred R. Conkling of New York, and the bill provided for elections in which the cities of the state were to determine whether or not they, as municipal bodies, would purchase and manage the street railway lines operated within their boundaries. It was also decided that a committee should be appointed to inquire into the reasonable value of the street railroads, the cost of operation and other matters by which voters might mould their opinions in the coming elections. The Assembly passed the measure, but it was not received with favor in the Senate. The committee of the Assembly, however, is going ahead with the examination. The state association of street railway companies is watching the investigation and it is not at all probable that the members will suffer from the movement, as the organization has considerable influence throughout the state. There is, as a matter of fact, no demand for the enactment and enforcement of such a law, and the reason for the solicitude of the legislators must be looked for elsewhere. It is possible that a junketing trip was all that the committee desired, or an opportunity to secure information that might be turned into political capital. Of course, in these days of reform it would not do to suggest that the entire scheme looked like a plan to sandbag the street railway companies of the state, but if it were not for the reform fad the idea might be entertained.

REAL estate men in New York voice the public mind when they demand rapid transit for the outlying districts. They call attention to the fact that each year the demand for dwellings renting for a moderate sum increases and becomes more imperative, and each year also, with the gradual enhancement of real estate values in the accessible portions of the city, it is harder to satisfy the demand. A leading metropolitan journal says that applications for houses are reaching agents very much earlier than usual this season, and many dwellings have already been taken from October. Complaints are heard that while there is no lack of costly residences to lease, comparatively few small dwellings in desirable locations are to rent, and there promises to be a dearth in this latter class before the return of families to the city becomes general. It is pointed out by real estate men that the requirements of persons of small income who do not care to live in apartment houses can only be met by the speedy construction of the rapid transit road, which would make the large and beautiful section of the city comprised in the northern end of the island available for improvement. The lack of adequate facilities for quickly reaching that portion of the city is yearly driving from New York many persons who, though desiring to live there, cannot secure satisfactory accommodations. As an additional reason for prompt action on the part of the rapid transit commissioners, the fact is cited that the yearly loss in taxes to the municipality through the impossibility of properly developing the district without rapid transit is very great. In New York there is increasing demand every day that the rapid transit commission make extraordinary efforts to begin at once the actual work of the road's construction. It has already been delayed too long.

IT is a pleasure to commend to the attention of our readers the carefully prepared and well written paper by Franklin L. Pope on the "Reconstruction of a Small Central Station Plant," which is presented in another part of this issue. The subject itself is worthy of the attention of all central station men, and as it is handled in Mr. Pope's excellent style it is worthy of special commendation. We fear that too little attention is given to the manner of presenting facts and figures by many writers on electrical and mechanical subjects. Many contributors to the current literature of these subjects do not attach enough importance to the value of clothing their ideas in good English and presenting them in an attractive style. Statistics important of themselves may be very dry and uninviting, or they may be interesting and attractive, according to the manner in which they are presented to the attention of the reader. No doubt much valuable information is passed over without consideration because of the manner in which it is served to the public. Those who engage in experimental work and investigations of general interest would do well to bear this in mind when presenting the results of their observation and recording their achievements.

Mr. Pope's excellent paper, which was prepared for the general meeting of the American Institute of Electrical Engineers at Niagara Falls, gives an account of his work in connection with the reconstruction of a central station established at Great Barrington, Mass., in 1888. His experience will prove valuable to others who may be called upon to undertake similar work, and his suggestions are worthy of consideration. He advises the use of incandescent lamps in medium-sized towns and cities where there are shaded streets, and he expresses a preference for 24 and 32 candle power lamps in such cases. The use of larger transformers is also commended and careful attention to the insulation of line wires is urged. Other points of construction and maintenance are considered and the importance of close attention to minor details of management impressed upon those in charge of central stations. Altogether the paper is replete with practical suggestions and should be carefully read by those engaged in operating as well as constructing central station plants.

ACTIVITY among inventors does not necessarily imply corresponding activity in trade, but one generally accompanies the other. The records of the Patent Office show that in prosperous times the inventive genius of the country is busily engaged in devising new or improved methods, little refinements in the arts, and labor-saving devices that are welcomed in the trades. It is therefore with no little satisfaction that we direct attention to the steady increase that has been noticeable of late in the number of patents issued each week for electrical inventions, as shown by the illustrated patent record of this journal. It requires only a glance to satisfy anyone familiar with the electrical business of the country that the devices upon which patents are now being issued, and those of comparatively recent date, rank higher in importance as a rule than those which preceded them for a year or more. While there have been no such electrical inventions of recent date as the telegraph, the telephone, the arc lamp or the incandescent light to startle the world, yet there have been many remarkable discoveries and improvements by later-day investigators. For instance, it is a question whether the original invention of the telephone or the development of the intricate details of the system that have made possible its universal commercial application is the more wonderful. There can be no question that the telephone of to-day, as the general public calls the comprehensive system of the transmission of speech, is as wonderful as was the first instrument which was given to the commercial world. Human ingenuity has been taxed to its utmost to bring this art to the existing high state of perfection, yet at the present time improvements are constantly being made, and with the promise of the opening of this field the interest in telephony has increased a hundred fold. The patent record this week and for many weeks past gives evidence of this. A corresponding improvement is shown in other lines, too—railway development, especially of the underground conduit type, power transmission, dynamo-electric machinery, transformers, measuring instruments—in a word, everything tending to improvement in station equipment for light, power and railway work is receiving attention. None of the important branches is being neglected, although of course preference is shown for such as give promise of immediate return. It is encouraging and gratifying to note this awakening of interest, and it may be taken as unmistakable evidence of the return of good times in the electrical business and allied interests. To our friends, one and all, we say: Be of good cheer; the days of trials and adversity are numbered; an era of prosperity is upon us.

## Prof. George D. Shepardson.

Among the men who have gained distinction as instructors in electrical engineering, few have made such rapid advancement as Prof. George D. Shepardson of the University of Minnesota. Not content with confining his efforts to the special work in hand at Minneapolis, he has contributed largely to bringing the necessity of technical training to the attention of men intending to follow engineering as a profession. That he has had experience sufficient to qualify him for passing an opinion upon this subject is shown by the sketch of his life which appears in the current *Year Book of the Society of Engineers* of the University of Minnesota, contributed by Prof. W. R. Hoag.

Prof. Shepardson was born at Cheviot, Ohio, in 1864. He is of the seventh generation from Daniel Shepardson, who came to Salem, Mass., in 1630. His mother, Eliza Smart Shepardson, is a descendant from John Smart, who came to Massachusetts in 1635 from Norfolk, England. Both parents are now living at Granville, Ohio, where for 20 years they were at the head of the Young Ladies' Institute, which by their endowment still flourishes as the Shepardson College for Women. The value of these educational surroundings in the formation of early tastes and habits is proved not only by the position which the subject of the sketch now occupies in his chosen profession as well as among his fellow men, but by the eminence already gained by brothers in business and professions, and by the social distinction enjoyed by sisters. While a mere lad Prof. Shepardson displayed a fondness for mechanics and machinery—prime essentials in his later chosen profession. As a school-boy much of his spare time was passed at a small machine shop near his home watching and frequently assisting the proprietor with various kinds of work, for which his quick perception and ready hand so well fitted him. Here his vacations were spent learning to handle batteries for electro-plating and in making a small dynamo, whose successful working did much to direct his thoughts and energies to electrical studies.

While pursuing his regular college work at Denison University in the classical course he continued his interest in scientific work. In addition to his regular studies, he acted as engineer in charge of the Siemens series dynamo, supplying light for the physical laboratory. His first practical experience in running arc light dynamos was here obtained. The construction of an electric motor during his spare time, using pieces of lamp burners, clock frames, stove bolts, etc., shows the decided inclination of his mind to electrical studies. Upon graduation from Denison in 1885, Mr. Shepardson had fully decided to prepare himself for some scientific specialty and to that end devoted the following year to physics, chemistry and mineralogy. Then followed a year's teaching in these branches at Granville, Ohio. Another year's work with the Edison Illuminating company of Boston, as motor inspector, then as night dynamo operator, furnished a valuable experience and revealed to the ambitious mind the vast field just opening in electricity. Appreciating this, and what was still more important, that to become a master in this work required a thorough knowledge in theoretical and experimental electricity, Mr. Shepardson spent the next two years at Cornell, graduating in 1889 with honor as electrical engineer. A summer spent as electrical expert with the Akron Electrical company, designing and constructing dynamos, permitted him to carry out some of his own ideas with flattering success. He also demonstrated the fallacy of their premises to another company proposing to revolutionize the ordinary methods by obtaining electrical energy directly from coal. Thesis work along the latter line had fitted him to give an opinion of high professional value, though very disappointing to the stockholders.

The unpleasantness and severe nervous strain attending such commercial ventures, as well as a call to an instructorship in physics at Cornell at this point, led Mr. Shepardson seriously to consider adopting teaching as his profession. His early experience as an instructor, as well as the unusually long and successful record of both father and mother as educators, led him to believe that, though commercial practice offered great pecuniary advantage, it was his duty to devote his life to training others. Acting on this conviction, he remained at Cornell a year, when he received the call from the University of Minnesota to the professorship in electrical engineering.

In the autumn of 1892 Professor Shepardson married Miss Harriet B. King, daughter of A. King of King's Mills, Ohio.

Prof. Shepardson is a member of the American Institute of Electrical Engineers, the Society for the Promotion of Engineering Education, and the American Association for the Advancement of Science. Perhaps in no department of his work has Prof. Shepardson made more valuable contributions than to the current literature of his profession through his numerous writings. These have appeared in many American electrical and scientific publications and in several foreign reviews.

## Opposition to Overhead Wires in Evanston, Ill.

Citizens of Evanston, Chicago's favorite suburb, are circulating a petition praying that the City Council order all telephone and electric light wires be placed underground. The petition claims that the overhead wires have already caused much injury to private property in disfiguring streets and mutilating and killing trees. "It has been for some time," the petition reads, "a matter of common knowledge and indignant complaint by citizens that in erecting poles and stringing wires the employes of the Evanston Electric Illuminating company and the Chicago Telephone company have shown entire disregard for trees that happened to stand in the way, and have by their reckless work inflicted great damage." Many instances are cited of where the electric light wires have burned and injured valuable trees, and where branches have been cut off and trees chopped down.

The offenses of the telephone company have been particularly aggravating in the eyes of the petitioners. "It has planted its poles in our finest streets and strung its wires in great bunches so close above the tops of young trees that they form an impenetrable roof over them and effectually prevent future growth. When trees have been in the way the operators have not hesitated to trim and prune them to suit their convenience. In one case where a fine row of trees along one side of a block was too high to suit them, they deliberately cut off the tops through the whole extent of the

PROF. GEORGE D. SHEPARDSON.

block and they placed a thick mass of wires above the mutilated remains." Under present ordinances the companies using such wires cannot be required to bury them until 1897.

## Electric Power for a Great Canal Lock.

The gates and gate valves of the great lock in the new Canadian canal at Sault Ste. Marie, connecting Lakes Superior and Huron, are operated by electric power. The lock is built of masonry, is 900 feet long, 60 feet wide, and has a depth of water of over 20 feet. General Electric apparatus is used, and the power generators and lighting dynamos are driven by turbines. The reasons which led to the adoption of electric power on the Canadian lock are stated by J. B. Spence, chief draftsman of the Department of Railways and Canals, in the *Canadian Electrical News* as follows:

As regards economy, I think the difference between electric and hydraulic power will be very trifling, and here the point of economy was not taken into consideration. One of the main objects of using electricity was to overcome the great trouble caused by frost when hydraulic machinery is used. During the closing weeks of navigation the cold is so great that oil has to be used in the hydraulic engines placed on the lock walls, and even then the cold causes the oil to thicken and makes the action of the engines slow and tedious. Of course, frost would not have interfered with hydraulic valve engines placed at the bottom of the lock, but in this case eight engines would have been required, while only four screw power machines are needed with the machinery as designed. These considerations seemed to make it advisable to use electric power throughout, and I have every reason to think that everything will operate successfully when we open for navigation.

It is proposed to build a belt line of electric railway about St. Augustine, Fla. The capitalists interested propose to light the whole line of the road at their own expense.

## Prof. Forbes Pays His Respects to Lord Kelvin.

Prof. George Forbes is kept busy these days in extending his congratulations to the public and the Niagara Power company over the fact that his eminent engineering ability was made use of in the much-discussed plant. In this pleasing employment he finds it necessary to administer a mild rebuke to Lord Kelvin, as will be seen by the following interesting correspondence in the *Times* of London:

*Sir:* Your New York correspondent lately announced the successful commercial delivery of electric current from the great 50,000 horse power generating station at Niagara Falls to the first consumers, who use it for making aluminum. I have also received reports of the thorough success of the practical working, and it will be interesting to many of your readers to know wherein the novelty of the work consists, and the value of the results to the whole world.

When I designed the 5,000 horse power dynamos, the largest in existence were of 1,500 horse power. The transformers which we employ, as well as other machinery, are also of far greater magnitude than any previously made, and this is part of the reason why the cost of these works is far below what any other engineer has been able to approach. There was nothing experimental in going to these large sizes; the nearest approach to experimental work was when I settled upon the machines for converting alternating into continuous current for the aluminum works, and these have now justified my choice. Such machines on a small scale were shown by Schuckert at the Frankfort Exhibition of 1891; but I took upon myself a great responsibility when making the first commercial use of them on so great a scale — four machines, each of 150 volts and 2,000 amperes. I selected as manufacturers the General Electric company of America, and they deserve the greatest credit for the result. This company has also made some novel and excellent machinery, which enables us to supply electrical energy at variable pressure to the 1,000 horse power electric furnaces of the Carborundum company. I will not refer to matters which I had to arrange for, but which are not yet completed. These include transmission of electrical energy to Buffalo, and its distribution; also the machinery for adapting the current for arc lights, for incandescent lights, for electric tramways, and for factories and mills. I mention these only to show the variety of requirements which had to be met, with strict attention to cost. Any customer may now ask either for continuous or alternating current at any fixed electrical pressure, or even at a variable pressure. My solution of the problem lay in (1) the selection of alternating currents, and (2) the reduction of speed of alternations as low as was possible, and (3) additional safety was insured by my refusal to allow live circuits to be suddenly opened or closed. If this last policy be not continued, the directors will have themselves to blame for trouble which must arise.

At the time when I decided upon alternating currents (which had not then been practically used for power purposes), many predicted failure, and some (including my friend Lord Kelvin) have continued to do so. Again, when I adopted low frequency, it was so generally condemned that I claim some foresight in having recognized its merits. I predicted low cost, high efficiency and increased safety as the results of low frequency, and in practice I have been altogether confirmed. The price charged (with handsome profit) is half a farthing per Board of Trade unit, for which English companies (under more difficult conditions, it is true) are charging about 6d., and from the time of the inception of this gigantic and novel plant until its commercial working at the present time there has not been a single hitch or mistake to correct.

The Niagara company make a greater profit by not going to great distances, as it costs them less to supply it near at hand. There is no difficulty or experiment in going to great distances; it is merely a question of expense and of the value of power at the place to which it is transmitted. There are plenty of places in the world where it will pay well to carry electrical energy 400 or 500 miles. I have no hesitation in saying that the low cost and perfect success, practically and commercially, of the Niagara works, opens a new era in the world's industrial evolution.

Your obedient servant,
GEORGE FORBES.

Athenæum Club, July 15th.

Lord Kelvin answers that:

This is not correct so far as the inclusion of my name is concerned. It is true that I advised the directors not to adopt the method of alternate currents; and the correctness of my advice is now illustrated by the fact that in the first practical use of the power it has been necessary to transform from alternate current to continuous current, for the electrolytic smelting of aluminum.

In giving my advice to the directors, I told them that they would certainly succeed with alternate current, but much better with continuous current.

Your obedient servant,
KELVIN.

Aix-les-Bains, July 28th.

Prof. Forbes to this replies as follows:

*Sir:* If Lord Kelvin were at home, with his documents to refer to, he would not have written the letter published in the *Times* to-day. On looking through his press copy-book he will nowhere find that he "told them" (the Niagara directors) "that they could certainly succeed with alternate current." On the contrary he will find copy of a cablegram, in the summer of 1892, to these directors, declaring my policy of using alternating currents to be a fatal mistake or a disastrous mistake. He will also find the same view supported in a lengthy letter which he wrote at the same date. He will also find that in his letter of November, 1894, he referred to this attempt to save them from disaster. Besides these specific occasions on which he volunteered this advice, he took further action in the same direction at various times. This was embarrassing to the officers of the company, and they did not disregard the ad-

advice of an [illegible] government without making sound reasons to justify their conduct, which I need not mention here.

As to Lord Kelvin's suggestion, in the letter published to-day, that it would have been better to distribute to all customers the current required by the Aluminium company [illegible] I can at present only state that [illegible] and ask "How about the [illegible] volts required for incandescent lighting, the 500 volts required [illegible] for arc lights, the [illegible] volts required for transmission to Buffalo, the alternating current required by the carborundum electric furnaces, and so forth?" Nearly everyone will now admit that the alternating current alone solves the problem well and economically.

Your obedient servant,

GEORGE FORBES.

34 Great George street, Westminster, S. W., July 30th.

## Electric Street Lighting.[1]

BY GEORGE CUTTER.

In considering a question like that of lighting streets, alleys and public squares, we should first define the results to be produced by the lighting system. The time has gone by when the whole object of our enterprising cities and towns in electric street lighting was to produce a sensation in the way of brilliant effects. This sentiment was all right a few years ago and was characteristic of American push and enterprise, but to day the question is not one of show, but of the best illumination. After defining what we mean by best illumination we can then study each system to see how nearly it accomplishes the theoretical results and at the same time presents the fewest practical objections.

It appears to me quite simple to define the theoretically perfect lighting, but it is not so easy to decide which system gives results nearest to the theoretical, as local conditions affect this question more or less. A general uniform illumination of mild intensity, such as that of a dark, cloudy day or possibly that of a clear night with a full moon, is the theoretical condition to be produced by artificial lighting. This is especially the case after bedtime.

There is an illumination better than either of these two for our study to reproduce artificially, and that is a clear night in winter in extreme northern latitudes. That is, the midnight light of the land a little south of the midnight sun. When we can produce this general uniform illumination of mild intensity, most desirable in a town gone to sleep, we will then have the best night illumination, and the rivalry which has led to the use of brilliant effects with really poor practical illumination will be replaced by attempts to produce the best approach to this theoretical condition, and the glare which blinds a man for half a block with accompanying inability to see for the next half block will become obsolete.

But this mild illumination, while it may be best for the outlying or residence districts during all hours of the night, is not sufficient for the business center during the earlier hours of the evening. So for proper results we must produce a brilliant illumination of this business center until bedtime, and for the sake of economy, we must then change the down-town illumination to the same mild intensity that serves for the residence districts earlier in the evening.

We, in America, are not accustomed to figuring on any definite illumination as expressed in candle power, but can easily estimate that illumination of a dark, cloudy day or of a moonlight night, which we want to reproduce as nearly as possible. There is one important factor in street lighting which might modify our practice in regard to the best general illumination. It is the police duty of the light in preventing crime and in facilitating the capture of criminals.

But even for this duty a uniform illumination of mild intensity is likely to prove best, because the eye which is adjusted to a bright light cannot distinguish objects in a dull light. So the thief or burglar would work with safety in a dark corner, when a few bright spots are used as the lighting system, whereas, the same corner with the same intensity of light would be a risky place to work in when the street lighting system gave a general illumination of mild intensity which would be free of the bad effects of great contrasts of light and shade.

For the same reason dark alleys should be avoided, even at the sacrifice of a uniform arrangement of our lights. There are various points to be considered when we come to the practical side of the question and try to determine what system will give the best approach to the theoretical results with the fewest practical objections. Among these points I might mention a few of the most important: First, we should consider the means of distribution to produce the nearest to our theoretical conditions, that is, we should aim to procure a uniformity of light, even of mild intensity, in preference to a few extra bright spots with intervening dark spots. Briefly stated another way, it is to avoid great contrasts of illumination. An exception can be made, as before indicated, for the business section before bedtime, a brilliant illumination of this section in the early part of the night changing to correspond with the rest of the city for the rest of the night. Second, reliability of service of the lighting system, since it loses its effectiveness either as a pathfinder or as a safeguard unless it is perfectly reliable. Third, steadiness of illumination is another point closely connected in importance to the one just mentioned, and in the same line of thought, viz., that of avoiding contrasts in illumination either in different localities or at different times. Determining the last two points, brings us to the fourth, necessary skill of all labor and ease of procuring the same, the employment of home talent to the greatest extent possible being usually advisable. If the installation and operation of the plant requires special skill, then absence of skill might cause bad service or even total cessation of light. Many a street lighting system has fallen short merely by disregarding this point. Then there is a durability of the apparatus, together with ease and economy of replacing used up parts. In considering this we must look out for both the probability of permanency of the supply of duplicate parts, and the amount of attention to keep all in good working shape. After careful judging of the closely related points thus far enumerated, we can well give attention to the sixth, which is efficiency of conversion from coal pile to light. My only comment on this point is that I place it second in importance to that of general uniform illumination, as high efficiency can well be set aside for the other more desirable feature of uniformity. Consideration of this point of efficiency lead to the seventh, total operating expenses, the importance of which depends almost entirely upon local conditions, as also the eighth point, cost of necessary plant for producing the light. This leads to the ninth, appearance of fixtures on streets and squares, and on this point more attention should be given than is the usual practice. It is not right to have line wires hanging loosely about our streets, the lights arranged along a straight street in a zigzag fashion and a general appearance of carelessness throughout the whole work. It costs but little extra attention and practically no extra expense to have the lights in a line, the wires straight, fixtures level or plumb as the case may demand. We have means at hand for the installing of arc or incandescent street lights so as to present an attractive appearance. The repair account in a trim and neat plant is always less than in a neglected one. All the help and all the citizens respect the fixtures in proportion to their appearance. What is more, a large share of the opposition to overhead wiring would never have been raised if it had not been for the bungling work which is so common.

DISCUSSION.

JOHN SCHUETTE: I agree with the writer in most things except that he says he would advise in the early evening in the business portion to have arc lights. Now I must tell you a little history in Manitowoc. They say in the early evening, in the business portion, they do not want any light at all; and there is good reason for it, too, because the houses and stores are lit, so that practically it would not be of any benefit. We have nothing but incandescent lights of 16 candle power. And, practically, the incandescent system of street lighting is the best. I admit if you want to make a display of luxury, you want to have arc lights. But I can hang out ten incandescent lights for the price of one arc light. I was requested to show the board of aldermen an arc light. Some people said our lights did not compare at all with our neighboring city of Sheboygan. They didn't know the difference between an arc and an incandescent light. I told them a 2,000 candle power light would cost ten times more than ours. It took a long time to explain the difference. But I say now that 16 candle power incandescent lights, when close enough together, make the best illumination you can have for a street. When you hang an arc light on the corner of a block about 325 feet long, it looks very nice toward the light; but you cannot see at all the other way; it blinds you. In the city of Manitowoc we have a population of about 9,000 to 10,000, and we have about 175 16 candle power lamps. We were having our little spats and wrangles with the council, and I gave them a little honey, as they say, which is better than vinegar. They said there were no lamps hanging across the streets. I said, Keep them as they are now. One of the aldermen said that in the town of Berlin they had arms in the street 14 feet. We took the committee down to Berlin, and when we came to the suburbs we saw all those little arms about a foot and a half long. Then they thought that it was up at Ripon instead of Berlin, about six or seven miles. So we took our baggage and went to the train, but before we got to the train I saw the man owning the plant and he said they had 21 arc lights. The alderman persisted that these long arms were used in a city in the state, and he wanted to go to Beaver Dam. The station man telegraphed to Beaver Dam and asked what kind of a light they had and how long arms they had. The reply was that they were nine feet. We took the train and went up to Beaver Dam, and we found them about a foot long.

W. H. THORP: There are places where the light is suspended over the streets. At Kaukauna the lights are suspended over the street on wires. I don't know of any place in the state where they have got those mast arms that Mr. Schuette went in search of. In most of the places where incandescent lighting is used the lights are on brackets, either on the pole that the line wires are stretched on or on separate poles. That is the way Beaver Dam is lighted. We have about 4,000 inhabitants, and have nearly as many lights as Mr. Schuette. Our streets are well lighted without arc lights. It would be difficult to light our streets with arc lights because of the dense shade all over the city except on the business streets.

MR. SCHUETTE: I notice that you had arms on the sidewalk instead of on the street.

MR. THORP: That is because the people travel more on the sidewalk than on the street. There are no pitchholes to get into and the horses don't need the light.

The CHAIRMAN: I judge we are coming to incandescent lights for streets, from what Mr. Cutter said.

MR. CUTTER: I did not say so. I am not sure but we are going to have an arc lamp of low candle power and high efficiency. I don't know but we are going to know how to paint our buildings with luminous paint, or some such thing. I simply outline what appeared to me to be the best illumination and that, the more we think it over, means general illumination of mild intensity. I still think the other point that I raised is an important one, in spite of the criticism of Mr. Schuette, whose practical experience I respect. That is, to make in the business sections, which in most of our towns is relatively small, a brilliant illumination during business hours. Get our people there, have them flock there and drift back and forth and patronize the stores and peanut stands and whatever else is there, and have all the entertainment possible during two or three hours of the evening in an illumination equal, perhaps superior, to bright sunlight. I would not keep that up all night because there is no necessity for it. The more we think it over the more we realize it is not good practice from a police duty standpoint, and that standard is an important one. Mr. Schuette well raises the question—we look at an arc light for a few minutes and for a few minutes more we cannot see anything. And of course if any of us are going to do evil in a town, we make use of that factor. I think that a mild general illumination is of considerable importance and certainly will be more and more considered, because the towns cannot bankrupt themselves to have this brilliant illumination all night. And furthermore, we are sacrificing the best total results by keeping it up. We might as well have it so that one trimming will do for two nights, that one expense will do for two nights on the arc lights, and put in so many more points of illumination of milder intensity. The more points we have, the more general the illumination will be.

J. H. HARDING: I would like to ask Mr. Cutter how long he thinks he could satisfy customers, the citizens in outlying districts. We put an arc light in the business district, and the man in the outlying district wants as good light as the rich man that lives down town.

MR. CUTTER: Of course all the members of this association will appreciate that this question of street lighting is one I am giving my attention to, and I do not hesitate to tell you that I have not touched upon the most interesting problems, because I cannot do it without describing my own outfit, and I do not want to do it before the association. I am not here to advertise my stock. As I said in my paper, it was a great hing for the American people to put in brilliant illumination when we first had the street lighting business, and the first town that used it in the state was the most enterprising. That is what has made the street lighting systems of America superior to the world, pushing ahead and having the best to be had and beating neighboring towns. Now we are going to beat the neighboring town in the future by the production of the best illumination instead of the greatest glare. I am troubled to-day to sell some incandescent lights for street lighting purposes, because the light I recommend is a small bulb and the customer says, "I want a big one." The people think if they have a globe that has double size, they have double the illumination. That sentiment is gradually dying out with the growth of information on the subject of street lighting—the more we all strive to increase that information, so that our citizens will not look for a great big globe of 16 candle power in prefenence to a small one of 25 candle power, the better. Our members, being more conversant with these problems all over the country and with the tendency of the times, should educate the people in the towns that a general illumination for street lighting in outlying residence sections is not inferior, but better than bright illumination in the business section.

T. F. GROVER: In our village of Wauwatosa we have both incandescent and arc lights for street lighting. I have found by consulting citizens that the incandescent lights are more satisfactory than the arc. In fact a great many of the citizens have made the remark that if an arc light were removed and three or four incandescents put in its place there would be a great deal more satisfaction. And I find it the same way myself. I think in the business portions a brilliant illumination is all right, but out in the small village, where they cannot have an arc light on every corner, and if they were on every corner the trees would hide them, you can put in a couple of incandescents and get better light and give better satisfaction.

MR. CUTTER: I would like to answer Mr. Schuette's criticism about making fixtures 40 feet long. The longest fixture I have made is seven feet from the post. That was at Elmhurst, and we put on a little filigree work to make it ornamental.

PLINY NORCROSS: The town of Sterling, in this state, I think was lighted by incandescent lights, but it afterward changed back to arc lights. The town of Broadhead is lighted with incandescent lights. In Janesville the people like the stronger light. We would like to hear from the gentleman from Madison.

C. GUNDERSON: We have arc lights in Madison and have not tried the incandescent. We started with 55 and have now run to 160 in about 11 years.

T. MERCEIN: If we are to give credence to Mr. Cutter's statement that his paper was written without preparation, he is to be congratulated upon his very satisfactory development of unconscious cerebration. Mr. Cutter's paper deals with the theoretical ideal light of the future, not with the comparatively crude and unsatisfactory light of to-day. So that the interesting experience of Mr. Schuette in the wilds of Berlin, Beaver Dam and other profane places in Wisconsin was hardly in place. I heartily congratulate Mr. Cutter on his paper.

MR. NORCROSS. In Boston the 1,200 candle power lights have increased more rapidly than the 2,000 candle power. That is a small watch dial. (Drawing his watch from his pocket.) When I drive home from town, there is one light at least 1,000 feet away from my house, and I can tell the time from that arc light the darkest night we have. Now, I think in the wild woods where they want trees as thick as they can be, and still want light, it is unreasonable. The arc light does give the stronger light.

MR. HARDING. While it may be true that you can see the time of day from that arc light, in driving along the road toward that light, if there happens to be any holes in the road, can you see them?

MR. NORCROSS. You are right about that.

MR. HARDING: I have been furnishing arc lamps for our city for 10 or 11 years. While we think our town is pretty well lighted, at the same time we realize that the system is wrong. We have got to change the arrangement of lights, which are two blocks apart, and overcome the two extremes—the extreme bright light on one corner and a dark spot at the other corner. A person driving along through the evening going toward the light, if not careful, will be liable to run into somebody before coming to the corner. In passing a bright light, and going to the corner where there is no light, you can see. It will only be a short time when we have got to come to Mr. Cutter's system of lighting.

MR. NORCROSS: Do you think incandescent lighting will supersede arc lighting?

1 Abstract of paper read at the convention of the Northwestern Electrical association, Chicago, July 18, 1895.

MR. HARDING: I do not know. It will unless we are able to get a small candle power arc light. We have got to change our present light to get more general lighting out of the same candle power to give greater satisfaction.

L. L. SUMMERS: I am not a member of the association, but I would like to say that in the incandescent lamp we get a candle power for about three watts of energy, and in an arc light we get two or three so-called effective candle power per watt. The term 2,000 candle power simply means that at one point we get that maximum intensity of illumination. The question of illumination from a given source is altogether dependent upon the surroundings. I think it has been conclusively proven that the height that lamps should be suspended is a serious question. We know the tower system in this country has come and gone simply because the lumination varies with the square of the distance. There is a serious question as to the dispersing of light which is being discussed, at least to some extent, in this country, and very much more abroad; that is, using indirectly the intensity of the arc light and reflecting it back as diffused light, producing a superior light, and above all, one that will not cast a shadow. At present I do not see any field for the incandescent lamp in its present shape, because the red and yellow rays of the incandescent lamp have not sufficient penetrating power as compared with the lighter rays of the arc light, together with the superior economy of the latter.

MR. SCHUETTE: We have those lamps suspended, I think, about 8½ feet, very low under the trees, over the sidewalk. We have others in Manitowoc about 17 feet high over the street. Of course we would get more light on the sidewalks. The gentleman here made an objection, and said that the city should be divided better for the benefit of the outlying districts. In our city each ward can designate the lamps it wants and it pays for the light. The small lamps are used in the outlying districts where with the arc light they would never get any light at all.

MR. THORP: Mr. Cutter said something about the police power in connection with these small lights. We have had the light for nine years and I don't remember that there has been a burglary committed in Beaver Dam, except one, and that was in broad daylight, week before last, the Fourth of July.

J. F. WILEY: We have both kinds of electric lights. Would it be better to put incandescent lamps all over the city, or set up those posts again and burn gas? We have taken them down. We have got 1,200 candle power and 2,000 candle power arcs. They take their choice. But I was thinking if we go out into the city and put up incandescent lights, why not resurrect those old gas posts.

MR. SCHUETTE. It would cost to light and extinguish gas what it would cost for the whole electric light.

P. H. KORST: We had a rather queer experience in Racine. About six years ago our place was lighted with 2,000 candle power arc lights, and when the city got ready to renew the contract, in order to defeat the gas company we pushed forward to 1,200 candle power arc light, and we secured the contract and have been lighting the city for the last five years with 1,200 candle power arc lights. Before that we had been accustomed to 2,000 candle power. The people were perfectly satisfied with the change, and we have had no complaints whatever and we do not notice a great deal of difference. The curious thing about it is, the first year we secured the contract for 1,200 candle power lamps we didn't have quite capacity enough of 1,200 candle power machinery to take care of all our lights, and we run one section of the city with 2,000 candle power light, although the contract called for 1,200. We didn't say anything to the people or council about it, as we thought it was an affair of our own, and we gave them a 2,000 candle power light at the contract price of a 1,200, and no one knew anything about it. But the peculiar point about it is that nobody noticed the difference. A person could go along the streets where we had the 2,000 candle power lights, and leave that district and go along under the 1,200 candle power lamps next, and nobody noticed any change at all. I even watched the lamps myself, and while I could tell the difference, it was not so great but what one would pass it over unless he was looking out for it, and we are perfectly satisfied now with 1,200 candle power lamps instead of the 2,000.

MR. NORCROSS: I would like to hear from Mr. Goltz. I take the *Daily Sentinel*, and I notice the people make some complaint in Milwaukee that they are paying a large price for light and don't get satisfactory results.

MR. GOLTZ: The city of Milwaukee is lighted with 2,000 candle power arc lamps exclusively, and I think the light is first-class, with the exception of the residence districts, where the streets are largely covered with shade trees and where the arc light is only to be seen at the crossings and not in the middle of the block.

MR. CUTTER: If you will allow me to refer to my paper, I do not think I compared arc lights with incandescent lights. I did not mention arc lights and did not mention incandescent, and there are two reasons for it. In the first place, I started out to try and define the theoretical results to be produced, then stating that we should consider our different systems to see how near they came to it. And in the next place I furnish both arc and incandescent lighting, and I do not want to hurt anybody's projects, or interfere with notions that will rule for a considerable time to come in spite of the best thought we can devote to the question. Mr. Wiley asks, Why not go back to the gas light? Of course the gas light is distributed in spots of light of low intensity, with all its imperfections, its foulness, globes, etc., that electric light men have been prating about for twelve or fifteen years. It is simply the survival of the fittest. The incandescent is a prettier and better light than gas light, and for the same reason will be preferred. The idea that you are going to send men all over town with matches and other paraphernalia for lighting the gas, and run to each lamp every night is not to be considered. We want something better. There are other advantages of electric lighting over gas. I do not know what the gentleman means by two or three candle power to the watt. I do not know of any lamp that produces such an efficiency. The average candle power of a 2,000 nominal candle power lamp is only about 400. With 450 watts, rated at 450, some tests have been made with a nominal 2,000 candle power arc lamp, so that was then just one watt per candle. Now for incandescent street lighting we use 2½ watts. Therefore the arc light has the advantage and efficiency. I put the question of efficiency in my paper intentionally second to that of producing the best theoretical results.

MR. MERCEIN: Mr. Norcross referred to the possible dissatisfaction in the city of Milwaukee with its electric lights. As the first manager of the Milwaukee Electric Light company, I built the first lighting plant. I think that the citizens of Milwaukee generally have not complained of the electric light in that city. You must remember that the council there is now engaged in the throes of debating as to the purchasing or constructing of its own plant, which is sufficient cause for newspaper articles to decry the present service in the city of Milwaukee. I might say that I am not now and for four or five years have not been connected with the plant. But I think it is not right to say there is general dissatisfaction in Milwaukee with its electric lights. The present price is $112 per year for 2,000 candle power. The first contract I made was for five years at $150 a year, which left a very fair margin of profit. The city of Milwaukee alone, I think, in the state of Wisconsin, has an underground system. Almost all of the business district is underground, a problem with which I struggled for many years. You can understand the great difficulty is unreliability of light. With all these difficulties, with the big prices, and with policemen keeping tab on each light and taking off the price of a light which happened to be extinguished, when a bill went to the council, it is not just to say that there is general dissatisfaction in the city of Milwaukee. They have now some 1,300 or 1,400 arc lights, and their contract expires next January; and it is natural that newspaper agitation should spring up on behalf of the people.

MR. NORCROSS: We had 90 lights and the council erected 64 more in the streets. If there is a better light, a more satisfactory light, I, among all others, would be delighted to find it out now, before it is too late. Last year I had great trouble in getting the citizens to allow the poles to be put in. This year the invitation comes, Can't you move the pole up to my corner?

F. A. COPELAND: I think it would be of use to this association if the secretary would obtain, as far as he possibly can, the number of incandescent and arc lights that are represented by the members of this association. He can very easily get out a short letter which can be answered on the same sheet, giving the number of lights and indicating about the amount of capital that he has invested. Last year our council was very anxious, and they were going to put in a plant of their own in about 15 minutes. There were several parties that called upon the committee that was appointed from the council, and gave it the benefit of figures for which they would put in a plant complete, ground, machinery and all, with between 170 and 200 miles of wire and 2,000 lamps for $25,000. There is no man in the world who does not know better than that. We want to know if the manufacturers of our lighting machinery can afford to make such statements to municipal authorities. We just want to throw out a little bit of warning. We have no objection to anyone who has anything to sell, going to anybody and trying to sell it. But they must not misrepresent it. It not only injures us in that way, but it conveys the idea to 99 per cent. of the average voters that where we have laid out $100,000 we haven't laid out $25,000. It is not only hurting their business, but is killing us, and is deceiving the public; and the quicker they find it out the better, I think. And I want to give a little bit of a warning to these men that follow up that kind of a business, that the patronage of one little city with a $25,000 plant is not worth quite as much as the patronage of the light represented by this association. And I move that the secretary be instructed to send a circular letter to each member of this association. with a proper place at the bottom to answer as to the number of incandescent lights and the number of arc lights and the capital invested by the corporation, or whatever he sees fit to put in, and have it ready to report on at our annual meeting.

[The motion was seconded and carried.]

## Electric Elevators.

The electric elevator is rapidly coming into general use. At first central station managers were rather dubious of the effect upon their lighting circuits of the sudden and heavy demands for starting currents for the elevator motors, but they have found that this service forms a safe and desirable addition to their business. Probably thirty or forty electric elevators have been installed in Chicago within the last year, and the business is also growing rapidly in the large eastern cities. The Sprague Electric Elevator company of New York is taking an intelligent and active part in this development. It now employs about 225 men and is working day and night, with a large amount of work in hand and more in sight. It is rumored that a local construction company is about to be organized in Chicago to exploit the Sprague elevator, but definite information on this point is not available. At any rate, the electric elevator, with its economy, compactness and convenience of operation has come to stay, and elevator men generally will do well to note the fact.

## New Orleans Investigation.

According to the press dispatches from New Orleans, J. H. Lafaye, foreman of the grand jury which found nine indictments against Maurice Hart, while investigating the sale of the street railroad franchises, says that the investigation showed the payment of between $60,000 and $70,000 as bribes to 19 members of the City Council, which consists altogether of 30 members. The grand jury hoped to get definite evidence against those who are alleged to have accepted bribes, but later abandoned the hope.

## Twenty-fifth Anniversary of the American Electrical Works.

The social event of the electrical fraternity in the East was the observance of the twenty-fifth anniversary of the founding of the business of the American Electrical Works of Providence, R. I., on Saturday, August 17th, when President Eugene F. Phillips extended that liberal hospitality for which he is so widely known at a reception held at Haute Rieve Union Club Country House, a beautiful suburb of Providence. This was also the occasion of the seventeenth annual Rhode Island clam dinner which the American Electrical Works have given. Fairer skies could not have been desired, and the visitors from far and near began arriving upon the early trains at Providence. Here they were met by the reception committee and taken upon special cars to Haute Rieve, where, after being registered, they were presented badges. Numerous games were provided for the guests and much jolly sport was witnessed at the target pulling machine and electric testing apparatus. Base ball and foot ball games also entertained those present. Fine music was provided by the Providence orchestra. At 12 o'clock the invitation for lunch was extended, after which a photograph was taken of all the invited guests.

It seemed a short while before the gong rang for dinner, but those who heard it were pleased, for they were a hungry crowd, and they endeavored to encourage the clam industry in Rhode Island. After partaking of an elaborate menu, for which 250 covers were laid, the visitors were called to order by President Phillips, and in a most happy speech he welcomed them and extended the greetings of the American Electrical Works. He referred in a feeling manner to many who had been present at former gatherings and who had now joined the great majority. His health was drunk amid cheers, all standing in honor of the occasion. President Phillips asked Thomas D. Lockwood to act as toastmaster. The latter suggested that those present drink in silence to the memory of friends who had passed away and to whom President Phillips referred. Ralph W. Pope was then called upon to respond to the toast "The Telegraph," and he told many very pleasing anecdotes of old times among the telegraphers. President Phillips begged the favor of the toast-master and asked that he respond to the toast "The Telephone," which was done by Mr. Lockwood in his most happy vein. C. S. Sargent of the West End company of Boston was then called upon to respond to the toast "The Transmission of Power," and gave some very interesting details regarding this subject. W. S. Key was called upon to respond for the "Press," which he did in his usual eloquent manner.

Regrets were received to the number of over 500, coming from all parts of the United States and Canada, and covering the telephone, telegraph and the general electrical business.

It will no doubt be interesting to readers of this journal to know that Eugene F. Phillips was one of the first to manufacture covered wire in this country, and began in a most humble way in a barn in the rear of 57 Chester street, Providence, R. I., in 1870. Wire was first delivered to the Gold & Stock Telegraph company of New York. In 1874 he moved to larger quarters on Stewart street in that city. Here rapid growth was made in the business until 1882, when a brick building was erected, which they were again compelled to enlarge in 1890 by 40 by 100 foot five-story building. Being still hampered for lack of room a change was again made in December, 1893, when they moved to their present large factory at Phillipsdale, about three miles north of the city.

An idea of the progress and increase in trade was given when President Phillips stated that he used only 30 pounds of copper per week when he first started the business, and now 75,000 per day was no unusual amount of material to be used in the manufacture of their products.

The Montreal branch of this concern, which is known as the Eugene F. Phillips Electrical Works, was represented by Secretary-treasurer John Carroll.

A beautiful souvenir, consisting of a little pan of clams, with an adornment of corn of metal nickel-plated, was presented to each guest as he departed, and was one of the happy incidents of the day, which will long be remembered.

To mention those who were present upon this occasion would be to speak of nearly the entire electrical trade, some 300 in all being present to testify their friendship upon this, the "silver jubilee" of President Phillips and the American Electrical Works.

Construction has been begun on the electric line connecting Buffalo and West Seneca. The road will be 4½ miles long

# CORRESPONDENCE.

## New York Notes.

NEW YORK, August 17.—A curious expression of the growing impression that electrical power is destined to become an important factor in the work now performed by steam railroads is found in a meeting held one evening last week in Jersey City. At this gathering 30 men employed by steam railroads organized a political club. The by-laws recite that the club is organized to secure the election of such candidates as may be relied on to carry out the wishes and protect the interests of the steam railroad men of the state. John Galvin was elected president, John Kenna secretary, and William Slack treasurer. Charles A. Kendig of Hoboken, who presided, said that the steam railroads paid their employes better than the electric roads. Electricity, he said, was steadily encroaching upon steam power in transportation. Bills had been introduced in the Legislatures of New Jersey and Pennsylvania last winter to give electric roads franchises for carrying freight, but they were pigeonholed. It was a question of bread-and-butter with the steam railroad men, he added, and they intend to fight an extension of the privileges of the electric roads. The men are adopting a futile and short-sighted policy, but they are evidently keenly alive to the signs of the times.

At a recent meeting of the Board of Electrical Control the secretary reported that since January last there had been removed 609 poles and 1,146 miles of wire. The question of granting a franchise to the East Chester Electrical company, which has been doing business in part of the district recently annexed, was referred to a committee.

In describing the dedication of a new Roman Catholic church in Red Bank, N. J., the local correspondent of a daily paper makes the astonishing statement that "Numberless arc and gas lamps light the building, many being studded in the ceiling."

A steam valve in the basement of the Edison building at No. 47 West Twenty-sixth street blew out at 8:30 P. M. on Thursday. The escaping steam severely scalded Louis Colny, 28 years old, of No. 766 Third avenue, who was working about the machinery. He was taken to the New York hospital. The escape of the steam made a great noise and caused a large crowd to collect in the street. Delmonico's Fifth avenue restaurant gets its current for lighting from this plant. When the accident occurred the machinery was temporarily stopped in order that the extent of the damage might be ascertained. This caused the lights at Delmonico's to go out for three minutes. The restaurant was filled with customers at the time, and the sudden darkness, of course, caused a good deal of excitement. A messenger was hastily sent to the electric light building, but by the time he arrived there the full current of electricity had been turned on and the lights at Delmonico's burned bright'y again. Most of the other restaurants and hotels in the neighborhood have their own plants and were not affected by the accident.

Car fenders occasionally do a good work. The *Sun* of the 15th instant relates this incident:

James Perrin, five years old, of Communipaw avenue, near Siedler street, Jersey City, ran across the street in front of his house yesterday just as a Newark trolley car was approaching at a high rate of speed. The motorman sounded his gong vigorously, turned off the power and jammed the brake hard down. The boy was so frightened that he stood still right in the middle of the track. The next moment the fender struck him. The car was not stopped until it had gone about 250 feet, and a crowd ran to the front to help gather up the boy's remains. Jimmy was found snugly ensconced in the fender, frightened half to death, but unhurt. "Well," remarked a passenger, "fenders do work all right sometimes." W. F. O.

## Milwaukee, Wis.

MILWAUKEE, August 17.—The city is all worked up about the matter of street railway franchises. For the first time in several years there is a prospect of the construction of opposition lines, ex-Congressman Lawrence McGann and his associates in Chicago appearing to be very much in earnest in their attempt to enter the field. The Milwaukee Street Railway company in particular is being stirred up. Although in the hands of receivers, it is displaying great enterprise, and new branch lines are projected almost every day. It has already got a franchise to build clear through the town of Lake, so as to tap Cudahy and South Milwaukee, and ordinances to grant it franchises in these two villages are pending before the county board. The McGann company, on the other hand, has asked the Common Council of Milwaukee for a franchise, and it is before that body that a battle royal will be fought. Mr. McGann and his associates have incorporated the Milwaukee General Railway company, with a capital stock of $1,000,000. It is hinted that John V. Farwell of Chicago is one of the subscribers to the company's stock. Little Milwaukee capital will be invested in the enterprise. Ex-Congressman P. J. Somers is lending the Chicago combination most valuable aid in the matter of getting franchises. He has been city attorney and mayor, as well as congressman, and by many is regarded as a match for the astute Henry C. Payne, who guards the interests of the Milwaukee Street Railway company. Mr. Somers, however, has little if any financial interest in the McGann company. McGann is depending very much upon the four-cent fare that his company promises, and upon a feeling that there should not be a monopoly of the street railway business. He even talks about the day of three-cent fares, which has already come to Detroit. The people of Cudahy and South Milwaukee do not seem to be very partial toward either of the two companies. They take the position that at least one of the companies will furnish them the necessary service, and that perhaps both of them will build lines to the two villages. Patrick Cudahy, the founder of Cudahy, is ranged on the side of the Milwaukee Street Railway company, his argument being that if that company builds to the village Cudahy will have the benefit of the very complete system of railway that is already established in the city, instead of depending upon the other company, which at best would have an incomplete system in comparison with the other one for a number of years. If the old company has any advantage in the villages, and it appears to have some, it is due to this consideration. When serious opposition was threatened it did not take the Milwaukee Street Railway company long, notwithstanding its receivership, to decide that it could build several new lines. It first came forward with a proposition to the village of Cudahy to extend its Russell avenue line to that city at once, the people of Cudahy to secure the necessary franchise from the southern city limits clear through to the south line of the town of Lake. A bonus of not less than $5,000 was mentioned in the original offer. An offer to build the line clear through to South Milwaukee, which seemed to be contemplated when the offer to build to Cudahy was made, soon followed. Mr. Payne had offered to make the fare from Cudahy to any point on the Milwaukee line reached by the transfer system 7½ cents. To South Milwaukee, which is several miles farther from the city, he offered rates of 5 cents from the village to the city limits and 5 cents from the southern city limits to any point in the city reached by the transfer system. As soon as possible ordinances granting the Milwaukee Street Railway company the right to build through Cudahy and through South Milwaukee were introduced into the village boards. The Cudahy ordinance gives the company the choice of three different routes. The first route is from the northern limits of the village along the Northwestern railroad tracks to Van Norman avenue and east to Packard avenue, and thence south to the southern limits. Another route is east on Plankinton avenue, instead of on Van Norman avenue. The third route is right through the village, from north to south, on Packard avenue. It is stipulated that work on the line must be commenced by September 1st and completed by December 1st. Cars are to be run at least every half hour. It is proposed to amend the ordinance so that two evenings in the week cars shall be run after midnight. In the ordinance pending before the South Milwaukee village board it is provided that the road must be completed and in operation by July 1, 1896, on penalty of forfeiture of the franchise. Twenty tickets are to be sold for $1, good between the village and the city or in the city. The route in the village is from the northern limits, at the intersection of College and Chicago avenues, south along Chicago and Tenth avenues to Milwaukee avenue, thence east to Ninth avenue and south on Ninth avenue to the southern line of the village. The town board of Lake did not take much time to consider the question of granting a franchise to the Milwaukee Street Railway company. The board met in the town hall on August 1st, about 200 people being present, and granted the franchise with a suddenness that must have astonished the statesmen of the Common Council of Milwaukee. Ex-Congressman Somers appeared at the meeting in behalf of the McGann company and in opposition to the granting of the franchise to the Payne company. His company, he said, would build a line through the town as soon as it could be done if allowed an opportunity to do so, and it would give a bond for the completion of the work. He doubted whether the Milwaukee Street Railway company, a bankrupt concern in the hands of receivers, could build the line after it got the franchise. Patrick Cudahy was on hand in the interest of the Payne company. The ordinance passed by the town of Lake supervisors provides that the rights conveyed shall be good for a period of 50 years. The route is from the southern city limits along Pennsylvania avenue, New York avenue or Chicago avenue to the Northwestern railroad tracks and along the east side of the railroad tracks to the northern limits of the village of Cudahy. The line must be built by July 1, 1896. In the city the influence in favor of granting the McGann company a franchise is so strong that the Common Council is not likely to be able to resist it. Messrs. McGann and Somers seem to be confident of getting the franchise, and one member of the council estimates that 20 out of the 36 members are sure to vote in favor of granting the franchise. Other estimates are a trifle higher. A most energetic campaign in the interests of the new company is being conducted. Mass meetings are being held in all the wards which the company proposes to reach by its system, and resolutions are being adopted declaring for McGann and four-cent fares, and calling upon their representatives in the Common Council to vote for opposition street car service. The Trades Council has adopted resolutions denying Receiver Payne's statement that poor people do not buy commutation tickets, calling upon the council to order four-cent fares, calling attention to three-cent fares in other cities, and making particular mention of Glasgow, Scotland, where only two cents is charged for short distances.

The ordinance introduced in the Common Council in behalf of the Milwaukee General Railway company provides that it shall have the right to lay single or double tracks and to maintain the necessary switches, etc., for a period of 50 years. The right of way asked for begins at the southern limits of the city, runs north on Logan avenue to Lincoln avenue, east to Lincoln avenue brige, along Lincoln avenue to Chicago avenue, north to First avenue, and along First avenue across the viaduct and along Sixth street to Sycamore street, thence to Fifth street to Locust street, to Seventh street, and thence to the northern city limits, with a line branching off on Locust street and going east across Folsom place bridge, east on Folsom place to Oakland avenue, and thence to the northern city limits. This line, it is proposed, shall be extended to Whitefish Bay. The ordinance also provides that on the South Side, beginning at the city limits, the city shall have the right to lay tracks on Windlake avenue to Eighth avenue, to Maple street, and along Maple street to First avenue. This line will give to the system on the South Side the form of a Y. On Sixth street, between Clybourn and Sycamore street, it is provided, the new company shall have the right to use the tracks of the Milwaukee Street Railway company, the distance being one block, upon paying to the old company a just and adequate compensation therefor, to be agreed upon between the two companies, and, in case they are unable to agree, then by arbitration, one arbitrator to be appointed by the mayor and one by each of the companies. The money is to be paid either in gross or in installments, according to the ordinance in that behalf provided. Many of the Milwaukee ordinances expressly provide that rival companies shall have the privilege of using the tracks already laid, and it has already been held here, arbitration in regard to the price being provided for, that the Common Council cannot grant exclusive rights over any of the streets of the city. The ordinance provides that the company shall give a bond in the sum of $25,000 to protect the city against all claims for damages arising from failure to observe any of the provisions of the ordinance and to insure the prompt building of the line. Only an injunction duly issued is to be taken as ground for not completing the road in accordance with the ordinance and, in case of an injunction, only the actual time of the delay caused thereby shall be allowed. It is provided that the company shall begin work upon the new line within 30 days after the passage of the ordinance granting it a franchise and that it shall construct at least five miles of main track a year until the system is completed. The ordinance provides for the overhead electric system. The poles are to be of iron, to be kept neatly painted and to be set no less than 125 feet apart. The tracks are not to be elevated above the street and the company is to maintain in good condition the street between the tracks and for a foot on each side thereof. The rate of fare upon the railway for distances between its terminal points or any part thereof, including any extension that may hereafter be built, shall not exceed five cents, and the company is required to sell tickets at the rate of five for 25 cents and to keep them on sale in all its cars. It is expressly provided that the company shall carry passengers from any one point on its line to any other point on its line for one fare and it is authorized to establish and maintain a transfer system for this purpose. And the McGann company binds itself to abide by any proper regulation of the Common Council whereby the tickets of one company shall be good upon the lines of any other company. It is also expressly provided that the company shall not run cars over the Sixth street viaduct until it shall, at its own cost, under the direction of the city engineer, widen or strengthen, or both widen and strengthen, the viaduct, as the safety of the public may require. The company is not to be allowed to pool or sell or assign its interests, nor consolidate with any other street railway company which is now operating or may hereafter operate in the city. The franchise shall become void in case this provision of the ordinance is violated. C.

## PERSONAL.

B. E. Greene, publisher of *Electricity*, New York, is spending a few days in Chicago.

William J. Clark, general manager of the railway department of the General Electric company, visited the Chicago office of that company last week.

Walter H. Morton, formerly foreman of the testing and expert department of the General Electric company at Schenectady, has been admitted to full partnership in the firm of Nightingale & Johnson of Utica, N. Y., which, as Nightingale, Johnson & Co., expects to do an increasing business as electrical engineers and contractors.

S. D. Flood, for four years connected with the power and mining departments of the Chicago office of the Thomson-Houston and General Electric companies, has resigned to accept the management of the Dallas, Texas, office of the Cotton Ginners' Compress company of New York. Mr. Flood left for his new field of labor on Monday. He took with him the hearty good wishes of the numerous friends he has made in the electrical circles of Chicago. Mr. Flood is well versed in machinery construction and operation and is withal an energetic business man; his talents, therefore, are such that he may be confidently relied upon to win success in his new venture.

Cards have been received announcing the recent marriage of A. M. Wilcox and Miss Amy Solomon at London, Eng. Mr. Wilcox was formerly a resident of Chicago and has many friends on this side, but he has been in London for several years and is now editor of the *Railway World*. He has been quite successful in England, and evidently intends to remain there. His American friends are no less sincere in their congratulations because of his acknowledgment of allegiance to a foreign queen, in his domestic life at least. THE WESTERN ELECTRICIAN joins the numerous friends of the young couple in congratulations and good wishes for the success of this international union.

## TRADE NEWS.

The Delaware Hard Fibre company of Wilmington, Del., has secured the recently awarded contract for supplying fiber to the General Electric company. The latter is said to be the largest consumer of this material in the world, and the contract was eagerly sought. The Delaware Hard Fibre company has recently more than doubled the size of its plant and is running day and night.

The Fuel Economizer company of Matteawan, N. Y., finds business is improving and is now very busy. Among some of the large orders recently closed are the following: Anaconda Mining company, Anaconda, Mont., 2,400 horse power; Edison Electric Illuminating company, Paterson, N. J., 2,000 horse power; Albany Electric Illuminating company, Albany, N. Y., 600 horse power; Toledo Traction company, Toledo, O., 2,000 horse power; West End Street Railroad company, Boston, Mass., 2,000 horse power; McCahan Sugar Refining company, Philadelphia, Pa., 1,500 horse power (second order); Lewiston Bleachery, Lewiston, Me., 1,200 horse power (second order); La Crosse Water Works, La Crosse, Wis.; Nonotuck Silk company, Florence, Mass., 200 horse power (second order); Dominion Cotton Mills company, Montreal, Can., 1,000 horse power (tenth order).

The Pennsylvania Electrical Engineering company of Philadelphia has been awarded the contract for the entire wire installation for the new building of the Fidelity Mutual Life association of that city. The Interior Conduit & Insulation company's tubing will be used throughout, with Habirshaw wire. There will be 1,183 outlets, with a capacity of 2,100 lamps. This concern has also been retained by R. J. Thompson of Philadelphia, as consulting engineers for the installing of a new electrical plant.

Lieut. E. J. Spencer, who, as the general representative of the General Electric company, was one of the most prominent figures in the electrical department at the World's Fair, was in Chicago on Monday. Lieut. Spencer now represents the Safety Insulated Wire & Cable company of New York, with an office at 510 Security building, St. Louis. He has charge of this company's cable business in the West, and has been notably successful, closing many important contracts, particularly in Chicago. Two of these have just been secured—that for seven feeder cables of 1,600,000 circular mils for the Lake Street "L" road and the cables for the Clark street line of the Chicago City Railway company. Within a year Lieut. Spencer has made four large sales in Chicago, the two former contracts being with Mr. Yerkes for cables running north and south from the Western avenue power house. Sixty miles of cable sold by Lieut. Spencer are said to be under the streets of Chicago for the North and West Side Street Railroad companies.

## BUSINESS.

The Electric Protection company of Phiadelphia has recently made an important change in its double-pole flush switch, by using an entirely new make-and-break action similar to that in use on the single-pole switch. This concern is preparing for a large fall trade by adding more machinery, and reports orders now on hand sufficient to make overtime work necessary.

The Electric Appliance company, Chicago, is sending out an advertising novelty in the shape of a printed wiring table that can be cut to fit inside the cover of a watch case, and is known as "Wells' Watch Case Wiring Table." The company has sent out several thousand of these, and will be glad to receive applications from anyone in the trade who has not received one. The table is mailed free on application.

The Universal Fire Alarm company of Philadelphia is receiving a large number of inquiries regarding its new automatic system, which has caused much favorable comment in insurance circles. Letters patent have been recently granted this concern for a new automatic safety device, which, it is claimed, will practically do away with danger from live wires. The company is at work on a large number of these instruments in order to meet the demand.

The Simplex Electrical company, through H. R. Hixson, western selling agent, has secured the contract for supplying T. Z. R. wire for the municipal electric lighting plants in Moorhead, Minn., and Independence, Iowa. The Moorhead order included all the construction material. Mr Hixson also secured the contract for wiring the fine new city hall in Milwaukee. He reports business as good, with a prospect of further improvement in the fall.

The Fiberite company, manufacturer of the Medbery overhead material and other specialties, is having a large trade in the station switches it lately brought out, and these specialties bid fair to become as popular as the line material made by the same company. The latter seems to be growing in popularity daily. Mr. Mason, the general manager of the Mason Electric Equipment company, selling agent for the Fiberite company, has just returned from a short but very successful trip. New customers were added to the already long list of roads using the Medbery material.

Hugo Reisinger of 38 Beaver street, New York, sole importer of the "Electra" Nuernberg carbons, states that the contract for the supply of high grade arc light carbons for lighting the Cotton States and International Exposition has been awarded to him. Charles F. Foster, the engineer of the Departments of Machinery and Electricity, in his requirements, states that the carbons must be first-class in every respect, and, being for exposition work, should burn as perfectly as possible. After having made an exhaustive test of various other imported carbons, Mr. Foster decided to adopt the "Electra" carbon, it having proved superior to any other carbons tested.

Western Representative G. W. Conover, of the Perkins Electric Switch Manufacturing company of Hartford, Conn., is much elated over having closed two very large orders for Waterhouse arc lamps and one for incandescent lamps. Mr. Conover is very much encouraged over the very satisfactory outlook for a good fall business. During the dull season the Perkins company has been kept well to the front throughout the western territory through the energetic efforts of its western representative, and now that trade is beginning to flourish the business-like policy of the Perkins company, with its excellent specialties, to say nothing of the company's increased facilities, will do not a little toward bringing in a handsome share of the fall business.

A battery of chloride accumulators, manufactured by the Electric Storage Battery company of Philadelphia, having a capacity of 216 kilowatt hours, has been sold to the Argentine Republic for furnishing light and power in one of the government buildings in Buenos Ayres. A contract has also been closed with the German Liederkranz society of New York city for a lighting battery with a capacity of 132 kilowatt hours. The Western Union Telegraph company is installing at Washington, D. C., under the supervision of its assistant electrical engineer, G. W. Gardanier, 796 chloride accumulator elements of various sizes. The company has opened branch offices at 333 Exchange building, Boston; 309 Dearborn street, Chicago; 15 First street, San Francisco; 215 North Calvert street, Baltimore, and 66 Broadway, New York. The office of the Electric Launch company will be at Morris Heights, New York City.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued August 13, 1895.*

544,278. Electric Rheostat. Francis B. Badt, Chicago, Ill. Application filed May 31, 1895.

The first claim is for the combination with a glass plate of electrical resistance conductors embedded in the plate and extended from the plate at intervals for connection with the contact terminals of the rheostat, and metallic plates between which the glass plate is adapted to be clamped and supported.

544,283. Conduit for Electric Conductors for Railways. Frank L. Capps, Newark, N. J. Application filed September 18, 1894.

Pairs of separable arms having extensions carrying terminals are adapted to be brought into electrical connection, and a compressible protector covers these terminals

544,289. System of Electrical Distribution. Stanley C. C. Currie, New York, N. Y. Application filed November 27, 1893.

The method of maintaining a constant load on the prime motor proposed consists in driving two mechanically connected dynamos by the prime motor, supplying the main or working circuit by one, charging secondary batteries by the second, and varying the field magnetism of the second by the current of the first, whereby the electromotive force of the second will be varied inversely as the load on the first, and the second machine driven as a motor by the battery when the load on the line is excessive.

544,306. Conductor for Electric Railways. Paul C. Just, Chicago, Ill. Application filed February 6, 1893.

The adjacent ends of two conductor sections are connected by a supported clamp of conducting material which is rigidly attached at one end to one conductor, and is provided at its opposite end with a detachable clamping plate connected with the body of the clamp by adjustable securing means, whereby the plate may be loosened to permit sliding of the other conductor end within the clamp, or may be made to clamp the conductor end more or less tightly as desired.

544,312. Trolley for Underground Electric Railways. Myron D. Law, Washington, D. C. Application filed January 31, 1894.

The features of this invention are a slotted conduit motor and two line conductors, a traveling contact device embracing two trolley wheels or contact pieces moving in contact with the line conductor, a supporting bar extending through the conduit slot, insulated connecting wires extending from the trolley wheels or contact pieces along the supporting bar to opposite terminals of the motor, and fusible couplings or fuses interposed between the trolley wheels or contact pieces and the connecting wires, the couplings or fuses being constructed to carry a current greater than the current-carrying capacity of the motor, but less than that supplied by the generator, whereby grounding of the current through the trolley wheels or contact pieces in contact with opposite line conductors will cut out one or both of the motors which are in circuit with the defective conductors.

544,313. Traveling Contact Device for Electric Railways. John C. Love, Philadelphia, Pa. Application filed September 5, 1893.

A traveling contact device for electric railways is described, comprising a supporting bar, a trolley wheel or contact piece, a trolley arm mounted to oscillate in a plane parallel with the line of travel of the contact device, and consisting of three parts, of which the inner one is connected with the intermediate one by a pivotal joint, the axis of which is longitudinal of the arm, and the intermediate one is connected with the outer one by a transverse pivot pin rigidly attached to the outer arm and extending through, and adapted to turn in the end of the intermediate one, a lifting spring, a restraining member, and a connecting arm attached to the pivot pin and reaching to a point laterally distant from both the longitudinal and transverse axis of the pivotal joints.

544,318. Multiple Fuse Switch. Josef Melzer, Saaz, Austria-Hungary. Application filed October 20, 1893.

The device comprises an insulated revoluble member, having recesses therein, a series of removable fuse carriers placed in such recesses, and suitable set screws or the like adapted to hold the parts in an assembled position.

544,329. Commutator Connection for Dynamo electric Machines. Henry H. Wait, Chicago, Ill. Application filed March 1, 1895.

The inventor claims the combination with a connection box, of conductors connecting the armature coils with the commutator segments, and inclosed in the box to protect the same from injury.

544,331. Globe Netting for Arc Lamps. Ernest P. Warner, Chicago, Ill. Application filed September 18, 1894.

There are an upper and a lower holder, between which the globe is adapted to rest, and pins or catches provided around the edges of the holders, and a wire or wires looped back and forth over the pins to form a removable netting.

544,332. Electro-magnetic Damper for Measuring Instruments. Ernest P. Warner, Chicago, Ill. Application filed September 18, 1894.

The claim: In an electrical measuring instrument, the combination with a coil or helix, through which the current to be measured is passed, of an armature mounted within said coil, and adapted to rotate about an axis parallel to or coincident with the axis of the coil, an index finger carried upon said armature, and adapted to move over a scale, and a metallic disk mounted to rotate with said armature, the disk being adapted to rotate in its own plane and in front of the end of the coil to act as a damper.

544,335. Telephone Switch. Frank R. Whitney, Lewiston, Me. Application filed June 30, 1894.

The combination includes a pair of contact surfaces in the same horizontal plane, a switch arm turning upon a pivot and shifting from one to the other of the contact surfaces, and a spring holder for a telephone which is rigidly attached to the switch arm and opens in the direction of its motion.

544,341. Multiple Switchboard System. Oro A. Bell, Brooklyn, N. Y. Application filed February 21, 1893.

The features claimed for this arrangement comprise a telephone line connected with spring-jacks upon different switchboards and terminating in a connecting plug at one of the switchboards, a test circuit independent of the line circuit extending to the different spring-jacks and connected with test contacts near the same, and a cord switch for the terminal plug adapted to alter the connection of the test circuit with a source of electricity to change the electrical condition of the test contacts when the plug is removed from its socket.

544,343. Magnet-forming Machine. Orlando P. Briggs, Chicago, Ill. Application filed January 20, 1894.

Rollers are provided with eccentrically mounted adjustable journals, the bar fitting the end of the journal and provided with the arc-shaped slot, and a bolt passing therethrough to secure the same in position.

544,345. Printing Telegraph. Charles L. Buckingham, New York, N. Y. Application filed April 16, 1894.

A blank is formed as an endless band or tube in combination with means for moving the blank step by step in the same direction both for letter and word spaces, and by an enlarged single step across the space between the end of one line and the beginning of the next.

544,346. Printing Telegraph. Charles L. Buckingham, New York, and Emil Germann, Brooklyn, N. Y. Application filed January 10, 1895.

The combination with the type wheel and an impelling or adjusting device, having positive mechanical connection therewith so as to move it positively in opposite directions, of a pair of actuating magnets operating on the impelling device oppositely, and means for energizing the same alternately.

544,347. Printing Telegraph. Charles L. Buckingham, New York, and Emil Germann, Brooklyn, N. Y. Application filed January 10, 1895.

In the same local circuit are combined, the double wound escapement magnet for the distributer, a double wound controlling magnet governing the circuits for the selecting relays connected to the distributer, and the double wound unison magnet for the distributer.

544,348. Printing Telegraph. Charles L. Buckingham, New York, and Emil Germann, Brooklyn, N. Y. Application filed May 20, 1895.

With the type wheel or platen there are combined two adjuster magnets and an intermediate lever, having two fulcrums, around either or both of which it may turn under the action of the adjuster magnets working singly or in combination.

544,351. Relay. Thomas B. Dixon, Henderson, Ky. Application filed November 17, 1892.

An electro-magnet, a pivoted armature therefor, and a retractile spring attached to the armature, two contact rods carried by the armature and insulated from each other, set screws engaging with one of the contact rods on opposite sides thereof, and so adapted to limit the movement of the armature, one or both of the screws being likewise adapted to serve as electrical contact points and to make electrical contact with the contact rod, and two swinging and spring-actuated contact levers engaging with the other contact rod on opposite sides thereof, and adapted to make electrical contact therewith.

544,358. Commutator Brush Holder. George J. Junker, Mount Vernon, Ill. Application filed November 9, 1894.

A compound brush holder is formed of a number of separate holders insulated from their support and from each other, and provided with an insulated rod passing through the series of brush holders.

544,301. Construction and Method of Operating Dynamo-electric Machines. Frederick H. Loveridge, Coldwater, Mich. Application filed August 2, 1894.

The machine described has two or more sets of pole pieces, [illegible] independent circuits equal in number to [illegible] set of pole pieces, two separate brushes forming the pairs of brushes constituting the terminals of the different circuits respectively, being placed under adjacent pole pieces of different signs, one brush of each pair being adapted to be adjusted, the adjustable brushes of the different pairs being all of the same sign, and the fixed brushes of the different pairs being connected by an equalizer.

544,305. Synchronism Indicator. Ralph D. Mershon, Pittsburg, Pa. Application filed November 12, 1894.

A coil is in series with the two machines to be synchronized, and a movable armature is in inductive relation to the coil, the position of which indicates the relation of the machines.

544,368. Strong Current Arrester. Frank R. McBerty, Downer's Grove, Ill. Application filed May 31, 1894.

The first claim follows: The combination with a heating coil of a small quantity of conducting material adapted to be fused by the heat of the coil, a switch spring held under tension by said fusible conducting material, and an electric circuit including said heating coil, fusible material and spring switch in series, whereby the fusing of said fusible material permits the movement of said spring switch to open the circuit.

544,369. Plug and Cord for Telephone Switchboards. Frank R. McBerty, Downer's Grove, Ill. Application filed September 18, 1894.

The conducting cord has a suitable covering; there is a sleeve within the covering, and means for clamping upon the covering outside of the sleeve.

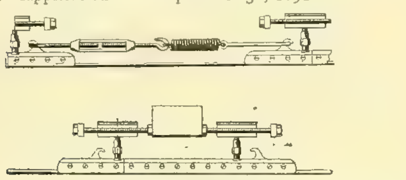
544,370. Automatic Signaling Device for Telephone Switchboards. Frank R. McBerty, Downer's Grove, Ill. Application filed December 26, 1894.

Combined with a connecting plug of a telephone switchboard are a source of electric current, a pair of switch contacts adapted to connect the source of current with the terminal contact piece of the plug and to disconnect it therefrom, mechanism adapted to separate the switch contacts periodically a limited number of times, an electro-magnet controlling the mechanism, and means for exciting the electro-magnet to operate the mechanism in the act of establishing connection with the line.

544,372. Manufacture of Electric Cables. William R. Patterson, Chicago, Ill. Application filed August 24, 1891.

Two or more conductors have a flat paper tape wound spirally around each of them, the tape being wound about the several conductors in the same direction, the conductors being twisted together to form the cable, the twist being in a direction opposite to that in which the tape is wound about the several conductors, whereby the tape wound about each conductor is loosened to form air spaces about the individual conductors.

544,373. Art of Drying Electric Cables. William R. Patterson, Chicago, and Charles H. Rudd, Evanston, Ill. Application filed September 30, 1891.



NO. 544,306.

Moisture is removed from the cores of cables by placing a core in the sheath or chamber, passing through the conductors of the core a current of electricity of a quantity sufficient to heat the conductors to a temperature which will vaporize the moisture contained in the core without carbonizing the insulation, and simultaneously maintaining a vacuum in the sheath or chamber surrounding the core.

544,374. Art of Drying Cores of Electric Cables. William R. Patterson, Chicago, Ill. Application filed April 18, 1892.

This method of removing moisture from the cores of cables provided with a protecting sheath consists in sending through the conductors an electric current of sufficient strength to heat the core by conduction to a temperature which will vaporize the moisture contained in the core without carbonizing the insulation, and simultaneously maintaining a current of gas through the pipe surrounding the core.

544,383. Electric Grounding Switch. Charles E. Scribner, Chicago, Ill. Application filed December 6, 1887.

The switch is provided with a lever or spring, and has a hood placed above the contacts to protect it from dust.

544,384. Single Cord Grounded Circuit System for Multiple Switchboards. Charles E. Scribner, Chicago, Ill. Application filed December 1, 1890.

One claim is given: The combination with the test circuit of a telephone line, of the terminal plug and cord thereof normally disconnected from said line, the operator's telephone, and a cord switch, adapted to connect said plug with said line when actuated, whereby the plug is connected with the line and the telephone when the plug is lifted from its socket in the cord switch.

544,385. Test Signal for Multiple Switchboards. Charles E. Scribner, Chicago, Ill. Application filed July 7, 1891.

In a test circuit there are a source of intermittent current of constant direction, and a second source of current of opposite direction to that of the first, and whose periods of intermission coincide with the periods of flow of the current from the first source, with a polarized electro-magnetic responsive device whose coil is included in the test circuit, adapted when actuated to strike a telephone transmitter, and a telephone having a coil included in the test circuit, and adapted to be affected in response to disturbances in the transmitter.

544,386. Telephone Switchboard Apparatus. Charles E. Scribner, Chicago, Ill. Application filed December 26, 1894.

Several pairs of connecting plugs with their uniting plug circuits, a telephone and listening key for each plug circuit adapted to connect the terminals of a conductor, including the telephone with the corresponding plug circuit, a plug seat switch for the final or test plug of each pair, the switch contacts thereof being included in the conductor between the telephone and the corresponding plug circuit to open the connection normally, a calling key and mechanism for simultaneously operating the calling key to signal, and the listening key to disconnect the telephone.

544,387. Electro-magnetic Signal. Charles E. Scribner, Chicago, Ill. Application filed January 8, 1895.

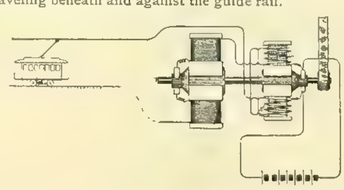
In an annunciator the combination is claimed with a solenoid or helix, of two bars or strips of soft iron extending through the opening or bore of the helix, and an annunciator target adapted to be displayed by the relative movement of the strips

544,388. Telephone Exchange System. Charles E. Scribner, Chicago, Ill. Application filed May 13, 1892.

As described, this invention comprises the combination with line circuits extending from each of several sub-stations to an exchange, of several switchboards at the exchange, an answering jack for each line provided upon each of the boards, a line jack for each line provided upon some one of the boards, a calling circuit extending to all of the sub-stations, and an electro-magnetic receiving device at each board included in the calling circuit, the several electro magnetic receiving devices being adapted to simultaneously respond to calling currents from the sub-stations.

544,391. Electric Railway Conduit System. Lorenzo H. Sherwood, Mount Vernon, N. Y. Application filed September 7, 1894.

In addition to the main conduit there is a tubular insulated secondary conduit supported within the main conduit entirely out of contact with all of the walls of the main conduit, and provided at one side with a slot and with a wire tube. The service wire is supported longitudinally within and above the bottom of the secondary conduit. The main conductor is supported within the main conduit outside of the secondary conduit; a branch feed wire is passed through the wire tube and connects the service wire with the main conductor; a longitudinal guide rail is arranged within the secondary conduit above and parallel with the service wire, and the compoundly curved trolley arm carries within the secondary conduit a vertically disposed double bearing frame, having a lower trolley wheel traveling on top of the service wire, and an upper guide wheel traveling beneath and against the guide rail.



NO. 544,289.

544,396. Winding of Dynamo-electric Machines or Motors. Elihu Thomson, Swampscott, Mass. Application filed January 27, 1894.

A laminated core is provided with projecting iron extensions between the coils, and each single coil or circuit which generates or utilizes an alternating impulse is divided and interspersed between projections that occupy different positions around the structure.

544,419. Electric Wire Containing Hat or Cap Band. Alfred M. Rodriguez, Brooklyn, N. Y., and Edward D. Rockwell, Bristol, Conn. Application filed June 10, 1895.

An electric wire-containing hat or cap band is provided with terminals for the application and removal of an electric lamp, and the application and removal of wires bringing an electric current to the band, and therefore to the lamp.

544,430. Support for Electrical Batteries Used on Vehicles. Thomas Froggatt, London, Eng. Application filed May 1, 1895.

In a support for electrical batteries a connecting piece is elastically mounted upon and insulated from the part upon which it is mounted, in combination with another connecting piece, adapted to make electrical connection with the elastically mounted connecting piece, so as to absorb vibration and prevent its transmission from one to the other.

544,436. Automatic Safety Appliance for Electric Conductors. Adelbert E. Hutchins, Detroit, Mich. Application filed May 9, 1893.

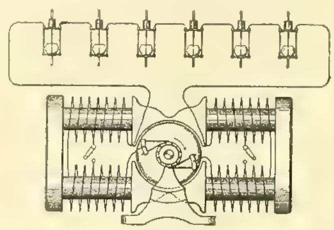
The appliance consists of forked arms, between which the conductor is received, and by which it is grasped and held as soon as it leaves its normal position, and a conductor of low resistance connected with the arms.

544,471. Trolley Wheel and Bearing. Edmond Verstraete, St. Louis, Mo. Application filed November 22, 1894.

The device combines a journal box, a carbon journal bearing mounted in the box, a vulcanized fiber plate mounted in the box, a shaft mounted in the box resting on the carbon and abutting against the vulcanized fiber plate, whereby flow of current through the ends of the shaft is prevented, and a cap confining the shaft within the box.

544,501. Cleat for Holding Electric Wires. Elisha W. Buffinton, Fall River, Mass. Application filed March 15, 1895.

In a cleat for holding electric wires there is the combination of the two parts, each having its face at one end formed into a longitudinally serrated surface, and at the other end into a transverse groove, provided centrally at its bottom with the line of independent depressions or recesses, each smaller in diameter than the groove contained therein.



NO. 544,633.

544,502. Support for Incandescent Lights. Charles A. Carmany, Middletown, Pa. Application filed September 8, 1894.

The first claim is: In a device of the character described, the combination with a block of supports carried thereby and having slots therein, clamping plates having slots, securing screws passing through said slots and into the block, and projections on said plates adapted to enter said slots in the supports, a shaft mounted on said supports, and a drum rotatably mounted on said shaft.

544,504. Street Car Sign. Jerome H. Deters and Charles Kiechler, Cincinnati, O. Application filed April 22, 1895.

Incandescent electric lamps are mounted in this sign, and are adapted to diffuse light through the colored glass and stenciled letters.

544,530. Apparatus for Insulating Wire. Tobias N. Hallanger, Chicago, Ill. Application filed November 14, 1891.

This is a combination with a spool support of a plate carrying the spool support, the plate being journaled and provided with suitable means, whereby it may be rotated, rotating guides journaled upon bearings secured to the plate, inclined relatively to each other and adapted to direct the insulating material upon the wire as they revolve about the center, and mechanism adapted to rotate the guides in a forward direction, whereby the insulating material is wound loosely upon the wire.

544,531. Insulated Electric Conductor. Tobias N. Hallanger, Chicago, Ill. Application filed February 18, 1893.

This is a cable composed of conductors twisted or bunched together, each of which is surrounded by a tube of insulating material, having an inside diameter considerably greater than the diameter of the conductor, to thereby leave an air space about the conductor, the tubes being formed of tape wound spirally about the conductors with the edges abutting or overlapping to form a tube surrounding the conductor, air spaces being thus provided between the several conductors formed into a cable to decrease the inductive capacity.

544,545. Signal Apparatus for Telephone Exchanges. Joseph J. O'Connell, Chicago, Ill. Application filed April 17, 1893.

With a trunk line connecting offices and a multiple switchboard at one of the offices there are visible "busy" signals corresponding with the trunk line connections of the switchboard, and a series of visible signals for indicating at one office that the desired connection has been made at the other office, local circuits wherein the visible signals are placed, relays for controlling the local circuits, and a battery suitably connected with both of the relays for operating the same at proper times.

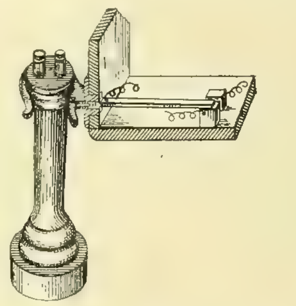
544,546. Apparatus for Telephone Exchanges. Joseph J. O'Connell, Chicago, Ill. Application filed April 17, 1893.

In this apparatus there are two signals, two electro-magnets of differing resistances for controlling the signals, a source of current arranged to energize both of the magnets, two outlets for current, a third signal and a magnet for controlling the third signal, the magnet being placed in one of the outlets leading from the source of current by which the magnets are energized.

544,552. Electro-therapeutic Appliance. John E. Wiles, Milwaukee, Wis. Application filed January 14, 1895.

An electro-therapeutic appliance, comprising a tubular metallic handle or casing, a series of galvanic cells located therein, but insulated therefrom, contact disks or electrodes secured to opposite ends of the handle or casing, but normally insulated therefrom, and having electrical connections with opposite terminals of the series of cells, and a suitable connecting device for electrically connecting either terminal of the series of cells with said handle or casing.

544,567. Electrical Signaling Apparatus. William W. Dean, St. Louis, Mo. Application filed September 24, 1894.



NO. 544,335.

This arrangement includes a plate having two perforations therein, two signaling plates arranged adjacent to the perforations, electro-magnets for operating the signaling plates, having their armatures connected directly to the respective signaling plates, and an interlocking extension from the armature of one of the magnets and adapted to be placed within the path of the travel of the armature of the other magnet.

544,578. Electric Arc Lamp. John H. J. Haines, New York, N. Y., and Alexander B. Fernald, Jersey City, N. J. Application filed November 20, 1894.

In combination with the base, there are a frame for the feeding mechanism, a hollow bolt connecting the base and frame and provided with a spline on its inner surface, a carbon carrier in the form of a screw passing through the bolt and provided with a groove extending longitudinally thereof to receive the spline a nut free to rotate upon the carrier, and means for regulating the rotation of the nut, substantially as set forth.

544,579. Electric Arc Lamp. John H. J. Haines, New York, N. Y., and Alexander B. Fernald, Jersey City, N. J. Application filed November 20, 1894.

A carbon carrier in the form of a screw of coarse pitch held against rotation while allowed to move longitudinally, a nut free to rotate on the screw, means engaging the nut for lifting it and the carrier, and a detent or clamping device carried by the lifting means and also engaging the nut to regulate the rotation thereof.

544,610. Process of and Apparatus for Extracting Ores by Electrolysis. Edward W. Clark, Butte, Mont. Application filed November 5, 1894.

This process of separating gold from its ores consists in mixing the ore with a solution of chloride of sodium and then passing said mixture into the presence of separated bodies of mercury in a regular succession, and at the same time subjecting it to the action of electricity, each body of mercury acting as a cathode.

544,633. Combination Dynamo. Ernest P. Warner, Chicago, Ill. Application filed February 24, 1890.

The feature of this invention is the combination with field magnet coils in an arc light dynamo, included in series with the working circuit, of a switch adapted to short-circuit a portion of the field magnet coils to reduce the field strength, the coils being short-circuited instead of thrown on open circuit to thereby afford a counter electromotive force to prevent surges of the field at the lesser strength, and brushes adapted to be moved about the commutator to a position of no spark under the new field strength, whereby the dynamo may be readily converted from a full arc to a half arc machine.

544,634. Electric Lighting Attachment for Gas Burners. Frank A. Webb, Beverly, Mass. Application filed March 11, 1895.

In combination with a Bunsen burner having air inlets and the incandescent mantle suspended above it, there are a stationary insulated electrode and a movable yielding electrode arranged within the mixing chamber of the burner, the latter electrode being connected for operation to a gas cock on the gas supply pipe, and adapted to break and close the circuit for the purpose of igniting the gas within the burner below its mantle.

# Western Electrician.

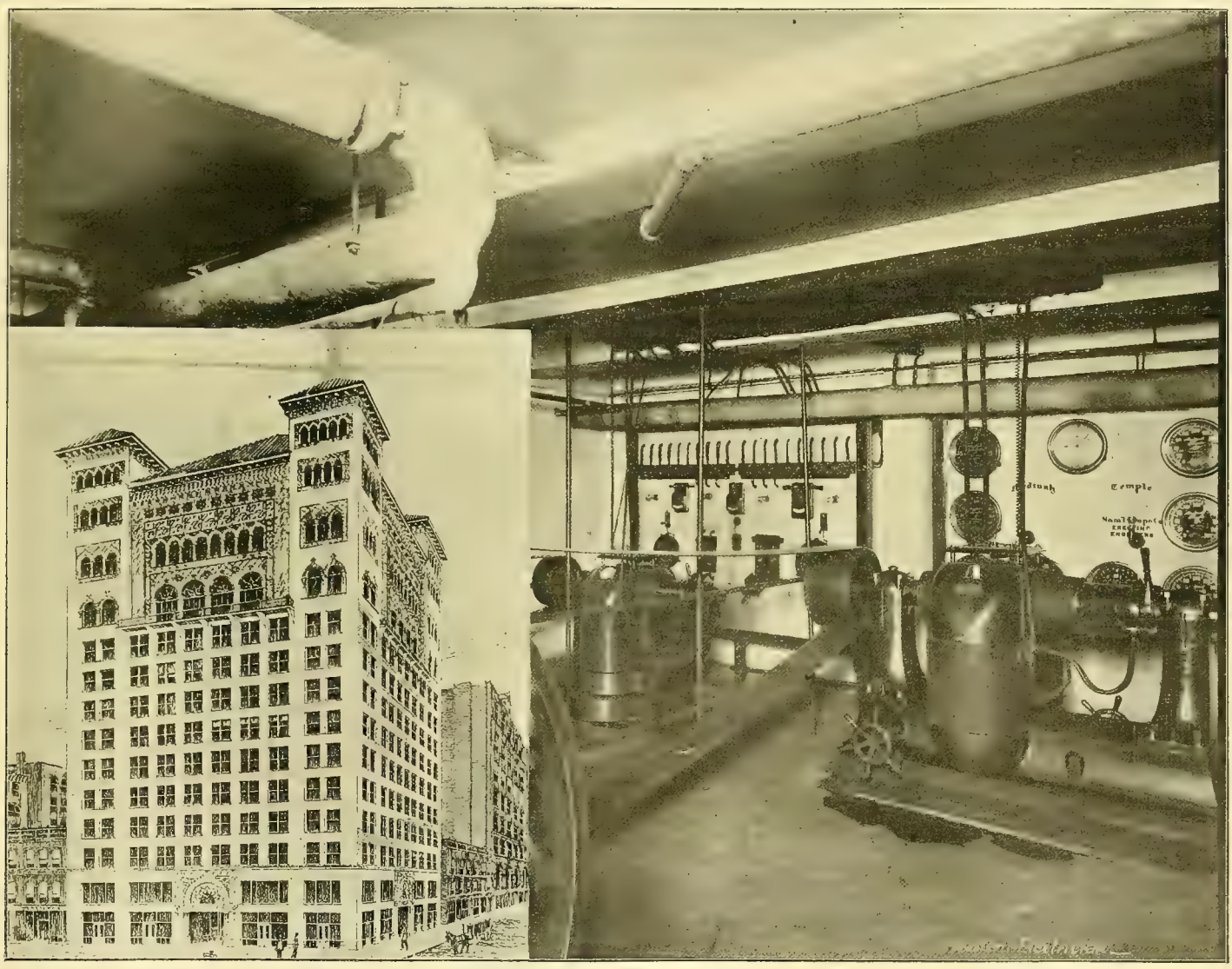
EVERY SATURDAY.

Vol. XVII. CHICAGO, AUGUST 31, 1895. No. 9


## Lighting Plant in Medinah Temple.

Attention is now particularly directed to the higher degrees of Masonry by the great conclave of the Knights Templar in Boston and the succeeding meeting of the imperial council of Nobles of the Mystic Shrine at Nantasket Beach. These gatherings give renewed demonstration of the numbers and influence of these organizations and are occasions of much pageantry and brilliant social activity. Boston is *en fête* this week and the electrical displays are conspicuous feature of the decorations.

Masonic organizations have erected many handsome buildings in the large cities of the country. Two conspicuous examples are in Chicago—the great Masonic Temple and Medinah Temple, the headquarters of the Shriners. The electrical plant of the former was described a few years ago in this journal, and advantage is now taken of a timely occasion to illustrate the lighting equipment of the latter.



LIGHTING PLANT IN MEDINAH TEMPLE.

Medinah Temple is at Fifth avenue and Jackson street, and, as the illustration shows, is a large and conspicuous building. The Arabic tracery and the Oriental effects of the upper portion of the building make it particularly noticeable. The structure is 12 stories high, but it is as tall as an ordinary 14-story building, as the eleventh and twelfth floors are devoted exclusively to the assembly hall, banquet room and other apartments of the temple proper, and are lofty and imposing. The first 10 stories are divided into stores and offices, although a portion of the tenth floor is at present used as club rooms for the members of the temple. The membership of Medinah Temple, which was organized in 1882, is over 2,200.

The electric lighting plant is in the basement and is shown in the picture. It consists of two simple engines directly belted to two bipolar dynamos. The engines are rated at 50 and 100 horse power respectively, and the dynamos have a corresponding capacity for 340 and 900 lights of 16 candle power each, the smaller machine being driven at 1,300 revolutions per minute and the larger at 900. The switchboard is of white marble, with Western Electric instruments. By its side is a gaugeboard, also of white marble, the two boards taking up one side of the room and forming a conspicuous feature of the plant.

When the interior finishing is entirely complete the building will be supplied with about 4,000 lamps. Fifteen hundred of these will be in the temple rooms, while the remainder will be in the stores and offices. The commercial and society portions of the building are quite distinct, and are wired on separate trunk mains. Although the total number of the lamps is large, the average load is light, as the tenants and the temple rarely require current at the same time. Then, again, the building is so constructed that all offices have outside windows, which reduces the demand for artificial illumination to a minimum. A number of fan motors are attached to the circuits, but in other respects the installation is a straight 110 volt lighting plant.

Experiments are now being made with a view of lighting Westminster Abbey by electricity.

## Hawaiian Government's Substantial Endorsement of the Cable Project.

According to the dispatches from Honolulu last week, the Hawaiian government has set the administration at Washington a good example by giving its approval to a project for an American cable between the Sandwich Islands and San Francisco, and pledging its financial support to the enterprise. The only opposition to the scheme came from the friends of the British project. The dispatches say that the Senate and House ratified the cable contract made by President Dole with Z. S. Spaulding, by which the government grants an exclusive franchise for 20 years, but provides that the grant shall not prevent any foreign government having existing treaty rights with the Republic of Hawaii desiring so to do to land a cable upon the Hawaiian group for other than commercial purposes from any point on the North American continent. The government agrees to pay the contractor an annual subsidy of $40,000 for 20 years from the date of the establishment of the telegraphic communication between Honolulu and a point at or near San Francisco and the islands of Hawaii, Moloki, Maui and Kauai, the subsidy to be paid in quarterly installments of $10,000 each.

Work on the cable must begin on or before May 1, 1897, and the line must be completed by November 1, 1898; otherwise the contract is void. If Spaulding fails to obtain assistance from the United States, the Hawaiian government may cancel its contract. The company will be ex-

empt from duty on material, taxes and port charges in addition to other privileges.

The maximum rates for messages, other than government messages over the cable between Honolulu and San Francisco, shall be such as shall be agreed upon in any contract which shall be made between the contractor and the United States government, not exceeding $1 per word, and any contract with such government shall prescribe a maximum scale of rates.

## Compounding Dynamos for Armature Reaction with Converters.

Since the paper by Prof. Elihu Thomson was read before the meeting of the American Institute of Electrical Engineers at Niagara Falls, on the subject of compounding dynamos for armature reaction, there has been a large amount of discussion among the electrical engineers of this country and abroad regarding the early history of this subject.

A representative of the WESTERN ELECTRICIAN had a recent interview in Boston with Dr. W. P. Freeman, who made deep researches into this subject in the early days of electrical invention. Some time ago, when Dr. Freeman was asked to give what information he had in relation to the converter system, he refused, but at the present time this journal is enabled, through his courtesy, to present the following statement, with the accompanying sketches. Dr. Freeman was asked to state, as nearly as possible, when he was able to present a practical demonstration of the converter system, and replied:

"In 1881 I perfected a machine on a principle of a compound dynamo for armature reaction (Figs. 1 and 2) which produced five arc lights or 40 incandescent lights, and I used in circuit a pole-changer and induction coils, or converters as is better known at the present time. When the incandescent lights were used the machine delivered 2,500 volts and 15 amperes. There were two converters, each about 12 inches in length, and I connected these two in multiple circuit, and dropped the voltage, as I remember, to either 50 or 75 volts, and ran forty incandescent lamps, a part of which were Maxim, with a filament often called 'M' or 'W.'

"I had this on exhibition for three months or more at my factory, 43 Center street, New York city. There were a large number of capitalists who came in during that time to investigate the system, and I finally made an arrangement and sold to W. F. Jobbins of New York city what was known at that time as the sub-dividing device of the electric light system, reducing a high voltage to any required voltage, and which was supposed at that time, and talked of, as being a wild idea, and Mr. Jobbins did not consider it of much importance. I therefore added to the same agreement the sale of the thermostat invention, which I was manufacturing, for one-fifth interest in the Jobbins Manufacturing company's works.

"In 1883 I constructed two machines, one a direct current machine and the other an alternator (Figs. 3 and 4). These machines, as can be readily seen, were practically the same as the machine I made in 1881, except the variations which were made to facilitate winding, and also to bring about a more perfect and even saturation of the magnetic flux. During that year I sold upward of 20 of this type of machine, which were much smaller than the first two manufactured, but which produced 20 incandescent lights of 16 candle power.

"In 1886 I made still a further improvement upon the previous design (Figs. 5 and 6); since which time I have manufactured several hundred small machines, and on March 27, 1888, I received a patent, No. 268,737, which proves to my satisfaction that these are the fundamental principles of this system as claimed by me; and according to my patents I do not see where a multipolar field machine can be used where only one-half of the pole pieces are wound, without infringing upon my patent.

"One of the claims allowed me was: 'The combination of a multipolar field magnet and multipolar iron armature corresponding in number of arms, or polar extensions, and having only half its total number of arms wound with generating conductor and commutator.'

"I do not consider this machine as an emergency machine, but one which is practical from every standpoint, as it can be made in all sizes, and will govern itself within 2 per cent. with a variation in speed of the armature of at least 10 per cent. without overheating."

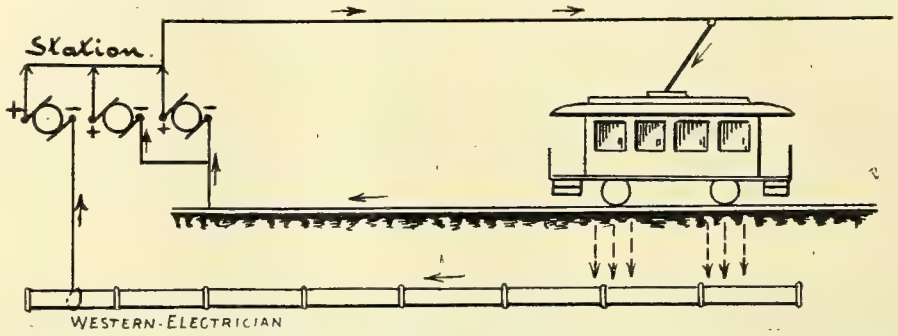



FIG. 1. ADDITIONAL SOLUTIONS OF THE ELECTROLYTIC PROBLEM.

## Additional Solutions of the Electrolytic Problem.

BY ARTHUR V. ABBOTT, C. E.

In a recent paper before the Northwestern Electrical association an endeavor was made to draw attention to the inevitable interference which must arise with the progress of electrical industries, owing to the common use of the ground as a portion of the circuits of a number of different electrical enterprises. It was further pointed out that probably the only absolutely specific and just solution consisted in furnishing each electrical enterprise with its own exclusive and appropriate metallic circuit.

The problem of the electrolytic action of street railway currents upon the underground structures existing in city streets was given prominence, owing to the importance of the interests involved. Lack of space prevented at that time an enumeration of all the possible expedients which might be used to accomplish, more or less successfully, the protection of underground structures. In addition to the two methods to which attention was directed, the complete metallic circuit and the introduction of special return feeds from dangerous points, three other expedients have been proposed which afford more or less partial solutions of the problem.

It has been suggested that corrosion from an electric railway could be avoided by operating the railway circuit as a three-wire system. A double track is essential, so that the trolley wires may serve as the outer mains, while the ground and the rails play the part of the neutral wire. This solution is defective, as it is impracticable to arrange the load on the two sides of the railway to a complete balance, and insofar as the system is out of balance the current must return through the rails and ground. Also, as the load on the two sides of the system is constantly varying over the entire length of the road, the current in the neutral conductor will correspondingly vary, and will in this way spread the injury to underground structures over a much larger territory, and render it impracticable at any time to determine where injury is about to take place. This expedient is only applicable to double-track roads and excludes all of the many single-track installations from consideration.

Harold P. Brown has proposed an arrangement which is diagrammatically outlined in Fig. 1. At the station at least two or more generators are required, the division of units being such that there is at least one special generator of about one-quarter the total capacity of the station, which is to be connected, as indicated in the diagram, directly to the pipe structures in the street. The remainder of the station generators are, as usual, connected to the rails or to the return feeds. If, now, the special machine be operated at a few volts higher potential than the rest of the station, it is quite evident that its action will be to render the pipe structures to which the negative pole of the special generator is connected electro-negative to the rest of the system, thus obviating electrolytic action. Such an arrangement of station machinery is undoubtedly a palliative. It is by no means a cure, for in case in any part of the pipe system there happens to be a high resistance joint, such a joint would become a point of inflection in the current, being electro-positive on one side and electro-negative on the other side. It is, perhaps, possible to locate such joints by means of a careful voltmeter survey, but only at the expense of considerable time and trouble, and when dangerous spots of this kind are determined the resistance of the joint must be obviated either by some form of bond or other device. It will be readily perceived that in many instances pipe structures will not return near enough to the station to render such an action as is outlined in the diagram possible, and frequently the pipe lines may be parallel to the railway track for a considerable distance and then lead away from the station in such a way as to render the application of this method impractical. Under these circumstances it will be necessary to determine by means of a voltmeter survey the condition of the underground structures and run to the danger points a special conductor.

Very recently Mr. Farnham has proposed an additional solution of the electrolytic problem, which appears to be one of considerable merit. The usual conditions, together with the remedy proposed, are outlined in Figs. 2 and 3. Under ordinary circumstances, the railway system is operated as shown in Fig. 2. The positive pole of the station is connected to the trolley wire and current passes from the station over the trolley wire and then to the rails. From this point it returns to the station by the route of least resistance, whether through the ground, the rails or a neighboring pipe line, as the case may be. At all points where the current leaves the pipe line or other underground structure, the line becomes electro-positive to its surroundings and affords points of danger, as is indicated in the diagram.

Suppose the circuit to be arranged as shown in Fig. 3. Here, as in the previous case, the positive pole of the generator is connected to the trolley wire, but the negative pole is not connected to ground in any way. On the contrary, the generating station is carefully insulated from earth, the negative pole being connected to a set of return feeds that may be strung along the route of the railway on the same poles that carry the positive feeds. At frequent intervals, say at every pole or every other pole, the return feed, which is otherwise carefully insulated, is connected to the rails only through sets of variable resistances, as indicated on the diagram. These resistances are proportioned in such a manner as to render all paths from and to the station of precisely the same resistance—that is to say, from the station *a* the resistance of the circuit from *a* to the farthest car and back to the station through *g* or *h* will be the same as the resistance from the station at *a* to the nearest car and back to the station through *i* or *f*.

A consideration of the diagram will render it quite evident that as the generators at the station are entirely insulated and as the return feeds are connected at frequent

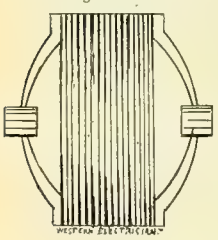



Fig 1.

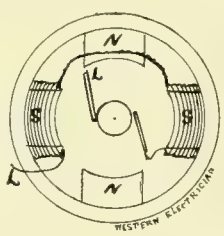



Fig. 2

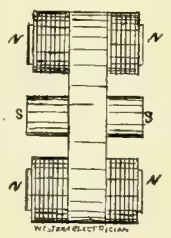



Fig 3

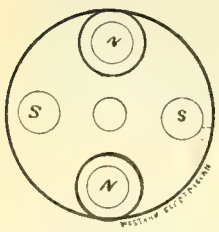



Fig 4.

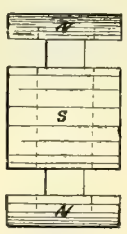



Fig. 5.

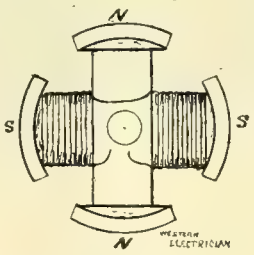



Fig. 6.

COMPOUNDING DYNAMOS FOR ARMATURE REACTION WITH CONVERTERS.

intervals to the rails in such a manner as to render all the paths of equal resistance, no current will flow from the rails, excepting such as passes from any car to the two nearest points of return to the return feeds, and under these circumstances there is little or no tendency for the current to leave the rails and pass to any adjacent underground structures. It is, of course, conceivable that a pipe line may be so near the rails—within a few inches of them, perhaps—that a slight amount of electricity may escape to the pipe line for a few feet; such cases would have to be particularly guarded, but would form an exceedingly infrequent exception to the general rule.

The objection to be urged against this expedient will inevitably be the additional expense required in the erection and maintenance of the return feeds, for this expedient amounts to giving the railway a complete metallic circuit, only using the rails to carry current between adjacent poles. There is no gainsaying this argument. It merely remains for the railway companies to face the inevitable position that they must either design railway lines in such a manner as to obviate the damage to existing underground structures, or to go out of the business.

It is absolutely certain that the time is rapidly approaching, if not already at hand, when no franchises will be granted to electric railway companies that do not contain a provision fixing upon the railway companies all responsibility for injury which may later be attributable to electrolytic action. In many instances the damage done by existing railway companies has formed a basis for legal proceedings, in every instance to the defeat of the railway company. It is certainly necessary, therefore, for those interested to look the situation squarely in the face and take such steps as in the future will relieve them from disagreeable responsibilities of this kind.

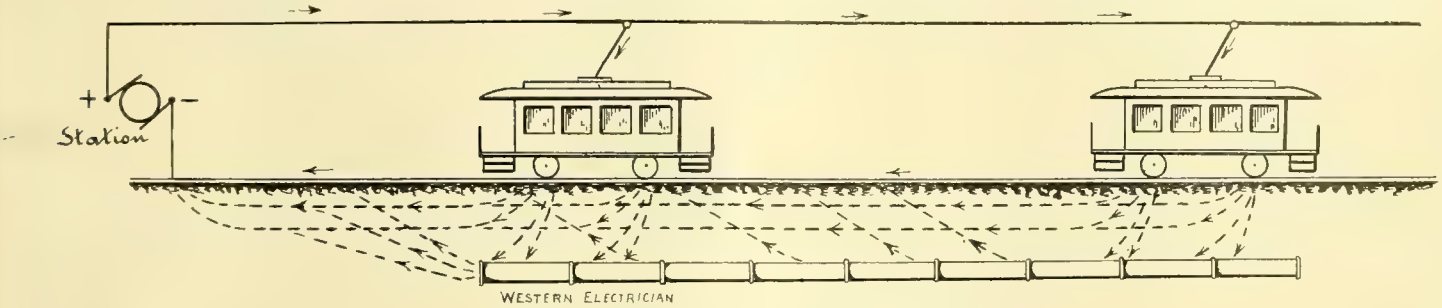



FIG. 2. ADDITIONAL SOLUTIONS OF THE ELECTROLYTIC PROBLEM.

## Boilers and Suggestions for Boiler Specifications.[1]

By John C. McMynn, M. M. E., E. E.

With the many improvements made during the last few years in the construction of dynamos, and the increased efficiency of both dynamo and engine, as well as all auxiliaries for distributing the electric current, it would seem that the acme of perfection had about been reached, and that no radical increase in economy could be expected in engine or dynamo. The boiler and its auxiliaries present a fertile field for the inventor and student. To be sure, there are men whose lives have been spent in the study of boilers, and the names of Babcock and Meier are as indelibly written in fame's book as those of Corliss and Reynolds. Simply as an example of the relative economy made by improving the engine and boiler, I present the following taken from actual practice in this city.

The usual amount of steam used in a simple non-condensing engine was 30 pounds per horse power per hour. In one case improvements were made, and a compound condensing engine installed and the consumption was reduced to about 18 pounds per horse power hour. Before the new engine was installed 100 horse power took 3,000 pounds of water per hour, and the average cost of this was, as is the case in the average Chicago plant, 60 cents per hour for 100 horse power. When the compound condensing engine was used the cost of 100 horse power was 36 cents per hour. In another plant improvements were made which reduced the cost of evaporating water from 20 cents per 1,000 pounds to eight cents per hour. This saving can be made with a much less investment than if new engines should be installed.

Personally, I am quite a friend of the old horizontal tubular boiler; and while admitting fully the advances made in water-tube boilers and the freedom from dangerous explosions due to their use, I think, however, that the horizontal tubular boiler will remain in use for many years, especially in plants where there is a sudden demand for a large increase of power for short intervals. The horizontal tubular is enabled to respond to this demand because of the large amount of energy stored in the hot water it contains.

Since the introduction of the high-class water-tube boilers, the old fire-tube boilers have been looked upon as old-fashioned arrangements which any maker could build out of any kind of material, and in any manner desired. It is because of this carelessness that we read of so many explosions, and I am of the opinion that had these boilers been built of first-class material and after approved plans, governing both the workmanship and the setting, many of these explosions would not have occurred. It is with this idea in mind that I have collected the best points of different specifications which have come to my attention and present them to you, trusting that you may find something of value in them.

### MATERIAL.

The almost universal material for building boilers to-day is steel. Some years ago this statement was enough, but to-day there are steels and steels, and some extremely poor stuff is passed off on the unsuspecting boilermaker, simply because it has the maker's name stamped upon it and the usual formula "60,000 pounds tensile strength." When it is known that a good percentage of the plate output is rejected by inspectors for larger and more prominent builders, even after the maker has stamped such plates, it must be admitted that the rolling mills will sell such plates to purchasers not having their material inspected, and where there are no chemical requirements. A conscientious boilermaker can refuse to make up plates which are of uneven thickness, or which are from crop ends of ingots, but without a chemical analysis he cannot know what the phosphorus is, or the sulphur.

### WORKMANSHIP.

In many cases the best of material can be so handled as to neutralize all of its benefits. Where rivet holes are simply punched, and carelessly at that, and the drift pin has to be forced to bring the holes opposite, strains are set up in the steel, which are very favorable for an accident if other conditions are just right.

Rivets should always, where practicable, be driven with hydraulic pressure, and with force enough to fill the holes completely. Otherwise, although the seams may be tight, the material will creep and throw an excess of load at some point.

The setting of the boiler is as important for economy as the design and workmanship, for even under the most modern water-tube boilers settings have been placed which allowed of no combustion chamber, and in which the gases were taken directly into the tubes and no fresh air admitted until after they have passed through the tubes and a higher temperature obtained in the base of the stack than among the tubes.

For a horizontal tubular I am greatly in favor of hanging the boiler from I-beams, which are supported independently from the walls. Many engineers insist that the longitudinal seams should be left hidden in the brickwork and not exposed to the fire. I prefer to carry the side walls up above the seams, leaving a space of at least four inches, preferably six inches, on either side of the shell. A small door at either end admits of frequent inspection of the seams, and if any leak occurs it can easily be located. Otherwise, if the seams are hidden in the brickwork, leaks will not be detected until the brick walls are saturated, and then cannot be located closely. Sufficient space should be allowed under the boiler to admit of some smoke-preventing device, many of which are very economical investments.

The fittings of boilers, such as water columns, feed pipes, blow-off pipes, valves, etc., are most important. I was recently consulting engineer during the erection of a boiler plant, where the lower connection for the water column entered the boiler on the side very near the water line, and was so incased in the brickwork that in no possible way could the pipe be cleaned, although its position was most favorable for collecting deposits.

All connections for the water column should be T's instead of elbows, so that the plugs can be taken out and all pipes easily scraped.

There are many ways of introducing the feed water, but as most modern plants use hot water this is not as important as when cold water was thrown directly into the boiler. The feed pipe should be at least 1½ inches for a 60 inch boiler, and not less than one inch for a 36 inch boiler. The blow-off pipe should always be two inches in diameter, except when water is bad and deposits large, when it should be 2½ inches. If a larger one is used the water does not discharge rapidly enough to carry away scale, etc., without becoming choked up. I have found it to be very advantageous to use two valves in the blow-off pipe, an asbestos cock nearest the boiler and a gas valve beyond. When the boiler is to be blown off the cock can be opened first and then the valve; after blowing off the valve can be closed first and then the cock. In this way the cock will not be cut, and will keep tight indefinitely.

The following specifications relate simply to horizontal tubular boilers. It is an extremely difficult task to write specifications for a water-tube boiler, and most of such specifications are written by the boilermakers themselves, or by some engineer simply to avoid recommending a certain type.

### SPECIFICATIONS FOR STEEL TUBULAR STEAM BOILERS.

These boilers shall be of the horizontal tubular type, and must be delivered on the grounds with all fittings and other appurtenances as called for in these specifications.

The boilers shall be 72 inches in diameter and 18 feet long; thickness of shell three-eighths inch; of heads one-half inch; shells to be made in three 72 inch courses on top, and on bottom there shall be one sheet 12 feet long and one sheet six feet long, the short sheet to be at the back end of the boiler.

Each boiler shall have 62 tubes, each four inches in diameter, thickness No. 10 B. W. G., made of best lap welded iron. The tubes are to be set in vertical and horizontal rows with as much space between them as practicable, but in no case closer than four inches. All tubes to be set in copper thimbles with Prosser expander and well bedded down.

The stays for each head above tubes to be 14 in number and 1¼ inches round, not less than four feet long; three stays in back head under tubes. If boilers have domes, the heads to have not less than six stays each. All stays to be crowfoot of standard proportions, the McGregor steel brace to be used.

Each boiler shall have two manholes 10 by 10 inches, with all proper plates, McGregor crabs and bolts complete, all to be of the Eclipse pattern. There shall also be provided in each boiler holes properly drilled and tapped for blow-off, feed and water gauges.

The shells, domes, heads and drums of these boilers shall be constructed of homogeneous steel, made by the open hearth process, and shall have the following properties and be of good finish and of uniform quality.

First—The ultimate tensile strength shall not be less than 55,000 nor more than 62,000 pounds per square inch.

Second—The elastic limit shall not be less than 32,000 pounds per square inch, with an elongation in eight inches of not less than 25 per cent.; the test sections shall have planed or milled edges, with a cross-sectional area of not less than one-half of one square inch.

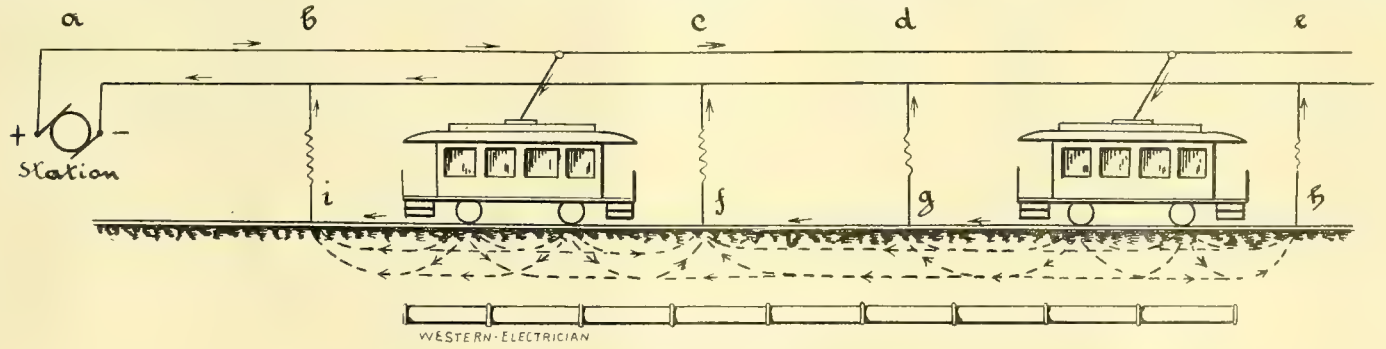



FIG. 3. ADDITIONAL SOLUTIONS OF THE ELECTROLYTIC PROBLEM.

1. Read before the Northwestern Electrical association, Chicago, July 18, 1895.

All steel must stand hot or cold bending, double and hammered flat to itself without showing signs of distress, and must be capable of standing the usual punching and punching and drifting tests.

When a sample is broken after being nicked, the appearance of laminations or cold sheets, or other imperfections, will cause the rejection of the plates.

All tests shall be made at the steel mills by such inspectors as the builder may appoint, and the contractor shall provide and prepare, under his directions, such sample from each plate as is necessary to determine its quality, and the contractor shall also give the inspector all requisite assistance without extra cost.

The builder also reserves the right to make chemical tests of the material, and if this shows more than .04 per cent. of phosphorus or more than .03 per cent. sulphur the plates will be rejected. Each sheet used in the construction of the boilers shall have the maker's name and the inspector's stamp on the outside.

Flanging shall be machine turned at a good red heat to a radius of two inches, and not a single blow shall be given after the plate is cooled down to less than cherry red. After flanging, all plates shall be annealed to the satisfaction of the inspector.

Rivets shall be of charcoal iron, "Burden," best three-quarter inch throughout, and no scrap work will be allowed; the longitudinal seams to be double stagger riveted and the girt seams single riveted. The rivets must completely fill the holes, have full heads concentric with the rivets and in full contact with the surface of the plates, and be machine driven wherever practicable. Rivet holes must be accurately spaced, and, if necessary, seamed to be truly opposite before the rivets are driven, and no holes shall have torn or ragged edges.

The use of drift pins will be allowed only for bringing the several sheets together, and must not be driven with such force as to disturb the metal around the holes.

First-class caulking and chipping on outside and inside of sheets will be required, and the lap of sheets shall be not less than $1\frac{3}{16}$ inches from center of rivet to the edge of sheet.

Each boiler when completed shall be tested to a hydrostatic pressure of not less than 150 pounds per square inch before leaving the shop and all seams must be tight. The steam pressure will be set at 95 pounds.

All material and workmanship will be subject to the inspection of the builder or his authorized inspector, who will reject all unsuitable or defective material or workmanship.

Each boiler shall be provided with full cast-iron fronts of neat design and well fitted together. Boilers will be set in batteries of two. On each boiler shall be four cast-iron brackets, or legs, on each side, with six three-fourths inch rivets in each, and underneath each leg a cast-iron expansion plate with three ridged spaces for rollers; the rollers to be of steel and a sufficient number furnished for each leg; or the boilers shall be provided with six plates suitable for connection in the hangers from three I-beam supports.

All castings are to be smooth and true, so that the rollers will have a free and easy bearing on the masonry.

All work or material necessary to render these boilers complete and perfect shall be furnished by the contractor, the cost of the same being merged in the contract price for the work.

The contractor shall furnish all transportation, labor, materials, tools, scaffolding, etc., for performing the work in the best possible manner, and to protect the work during its construction, for the price named in the contract.

The nature and intent of these specifications is to provide for the work herein enumerated, to be complete in every detail for the purpose designed, and the contractor hereby agrees to furnish any and everything necessary for such construction, notwithstanding any omissions in the drawings or specifications.

Proposals must be made strictly in accordance with the following form, and the prices attached must include everything necessary for the construction and completion of the work as herein specified and described.

BOILERS OF OTHER DIMENSIONS.

The foregoing relates simply to a 72-inch horizontal tubular boiler, and for other dimensions I have used the following proportions:

| Diam. | Length. | Shell. | Heads. | No. tubes. | Diam. |
|---|---|---|---|---|---|
| 60 inches. | 18 feet. | 11-32 in. | ½ inch. | 44 | 4 inch. |
| 54 inches | 16 feet. | 5-16 in. | 7-16 inch. | 48 | $3\frac{1}{2}$ inch. |
| 48 inches | 16 feet. | 5-16 in. | 7-16 inch. | 28 | $3\frac{1}{2}$ inch. |

However, these specifications cover the ground and can be changed to meet any particular case.

In asking for water-tube boilers it has been customary to ask the builders to guarantee an efficiency or a high evaporation. In most cases this has been unsatisfactory, as the highest priced coal is used on the test and the boiler has everything in its favor. The owner cares nothing for efficiency if to gain it he has to burn a coal costing $4 or more per ton, when he can buy coal for $1.50 or $2 per ton. I would suggest the following as a means of knowing just what the boiler will do under ordinary conditions.

The maker shall guarantee the cost of evaporating 1,000 pounds of water from and at 212°, using whatever coal is, in his opinion, the most economical, and shall name each coal in his proposition. The owner reserves the right to purchase such coal in the open market.

| Where coal costs—per ton delivered. | Cost of evaporating 1,000 pounds of water from and at 212° shall not be more than |
|---|---|
| $1 00 | 7½ cents. |
| 1 50 | 10 cents. |
| 2 00 | 12½ cents. |
| 2.50 | 15 cents. |
| 3.00 | 17½ cents. |
| 3.50 | 22 cents. |

The foregoing is taken from actual tests on different types of boilers, and I know that any well constructed modern boiler can meet these costs if care is taken in the setting. It is also well enough to ask the maker to guarantee the repairs, under good management, for two years.

I do not wish to be understood as favoring a horizontal tubular boiler rather than a water-tube, but present the above for those whom it will interest, and who either have or are about to buy horizontal tubulars.

DISCUSSION.

MR. STEPHENS: In Mr. McMynn's paper he mentions the advisability of using a 12 and a six foot sheet. I would like to ask in which end of the boiler you would place the long sheet?

MR. MCMYNN: I would place the long sheet at the front end of the boiler.

PRESIDENT GRIMM: I was somewhat surprised to hear you advocate the idea that the walls should not be drawn in until after they had passed the lateral seam. My impression had always been that that seam should be carried up above the boiler sills, so that the fire would not strike the ribs. The reason you give is, that you can detect a leak quicker. But is not a leak more likely to occur when it strikes it direct?

MR. MCMYNN: I will say that that was first brought to my attention at the Brilliant pumping station in Pittsburg. There they had 72 inch boilers. On this plant they carry the side walls up with about six inches space, and above the seams, giving much more heating surface, and at the same time leaving their seams in the fire. I questioned Mr. Shepherd very closely on that point, asking him why he did it, and his arguments were so good that I was won over. I found his boiler would evaporate more water and give better service by having that combustion chamber way up there. Both material and workmanship were carefully inspected, and I think when that is the case, there will be no leaks. Of course if you build up a quick fire you might strain it slightly, but after you have got it hot, it is only the temperature of the water any way, whether it is in the fire or out of the fire. The water and steam keep it at, say, 360° or 380°. The main trouble with marine boilers is that material three-fourths of an inch thick forms a stiff seam, a ridge point in the circle, and as bending takes place at either side of that seam, it strains the metal on either side of the seam. I think it would be better to heat the seam entirely and keep it hot, and when you cool it down, do so gradually. In all the boilers that have been put up in this way there have been no leaks. The other boilers have had leaks and we could not find them and had to tear out the side walls. But if there is any leak in that seam we can detect it right away. Otherwise you have to tear down the walls to find the leak and be at considerable trouble in getting at it.

MR. STEPHENS: The temperature of the sheet and the boiler being the same, if the boiler was covered in some other method than with a brick arch, say with non-conducting asbestos covering, would it not be better under those conditions to have the seam above the fire, and is that not a better covering than the usual brick covering in any event?

MR. MCMYNN: If the boiler had an asbestos cover instead of a brick covering, yes; if the heat under the shell of the boiler passes immediately through it and is taken up by the water, how can we have any higher temperature than the temperature of the water? We cannot, because as soon as it gets hotter it is absorbed and the steam pressure goes up.

MR. STEPHENS: The temperature will be even all through the boiler and why would it not be better to have it up above?

MR. MCMYNN: I don't know but it would, but very few people can afford to cover their boilers with that kind of covering.

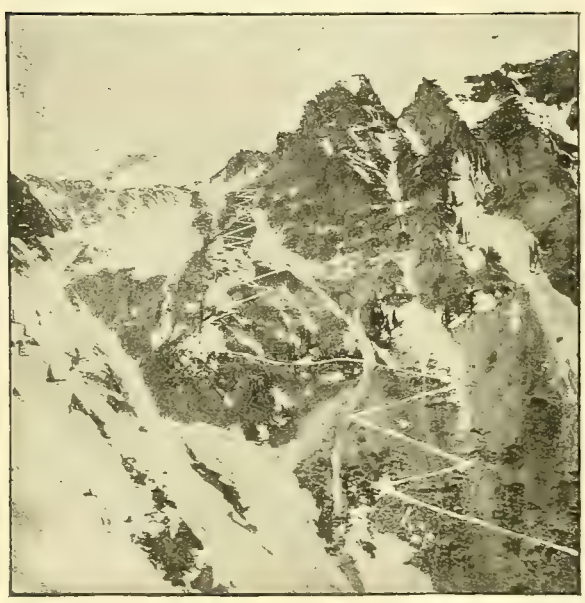
MR. STEPHENS: That covering costs but very little more than brick covering, and I think it is preferable. You can get at the seam by taking out a sheet of this asbestos covering, with an air space. I think it is better; it is lighter and much cleaner.

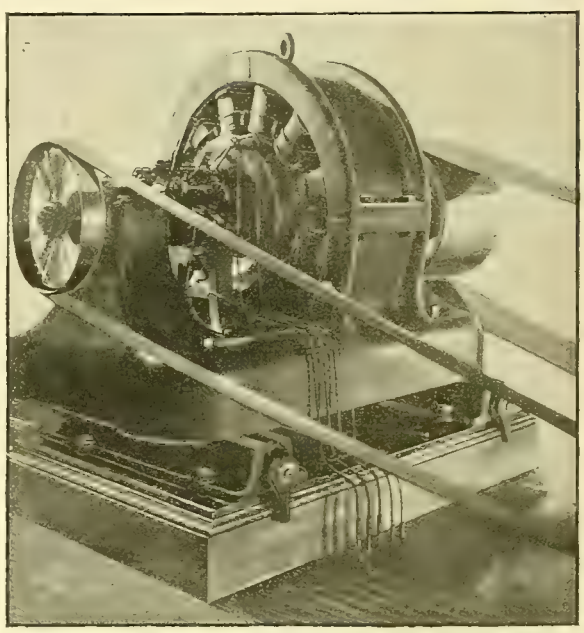
MR. MCMYNN: It is used to a very considerable extent. It is my idea that after the gases enter the tubes you gradually stop the combustion and you have got to have a good combustion before they enter the tube. The more combustion you can get there to supply that heat, the more you are going to absorb. I found that by shutting up some tubes of the boiler and testing the boiler, say for ten hours, and then opening up the tube, that it does not make any difference with the boiler at all. Therefore, I argue that the tubes are simply to carry off the products of combustion, and should not be counted as efficient heating surface as other parts of the boiler. No boiler ever had a better heating surface than the Peck boiler. It has half-inch steel, but as long as it is hot, the heat must pass through the brick, through the half-inch steel into the water, the tubes merely carrying out the gases. We all know that with a firebox boiler we get some of the best results in the world. On the drainage canal not long ago, a friend of mine put in two fire-tube boilers with 30-inch fire tubes. They had to shut down. They took those out and put in a boiler of exactly the same dimensions, with a big firebox over it, and that boiler was never shut down an hour. I claim that the combustion chamber and combustion under the boiler is the best, and that a square foot of it is equal to four or five square feet of one of the tubes, or even more.

PRESIDENT GRIMM: How many pounds pressure is ordinarily carried and used in a boiler, say 60 inches in diameter, 16 feet long, with three-eighth inch shell and one-half inch head?

MR. MCMYNN: There is no trouble in carrying 125 pounds if the boiler is carefully inspected and looked after. About 100 pounds is usually carried. In the Pittsburg company's station they are carrying 125 pounds with a 72 inch boiler with $\frac{1}{2}\frac{1}{6}$ inch shell.

MR. TATNALL: Mr. McMynn says that with a tubular boiler the heating surface under the boiler is more efficient than in the tube, the tube simply carrying off the gases. I think combustion that takes place under the boiler produces better heat in the tubes. It is the combustion under the boiler that gives heat, but heat is absorbed through the tubes and not through the shell, because the Peck boiler





FIGS. 1 AND 4. FIRST THREE-PHASE PLANT IN THE ROCKY MOUNTAIN REGION.

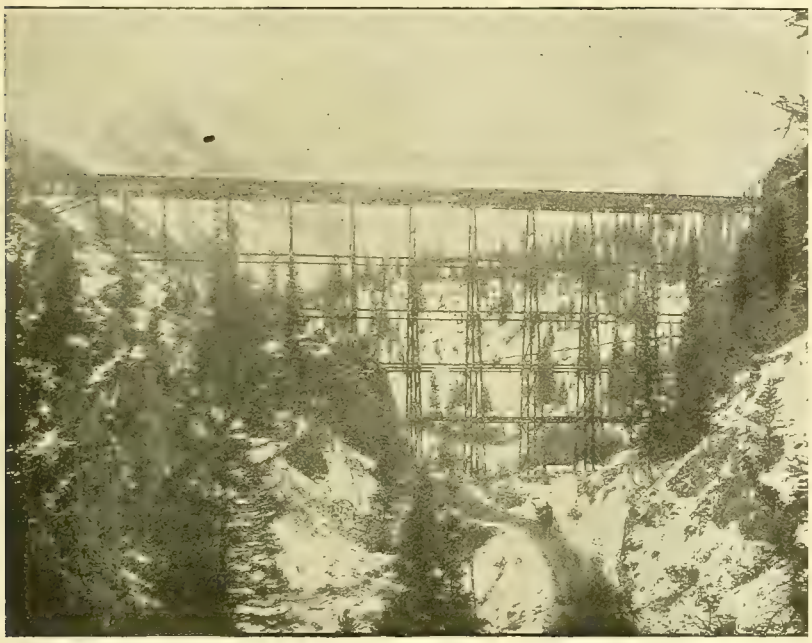
has no heating surface. The brick arch simply keeps the flame from impinging on the shell, and I would like to ask why that is not right.

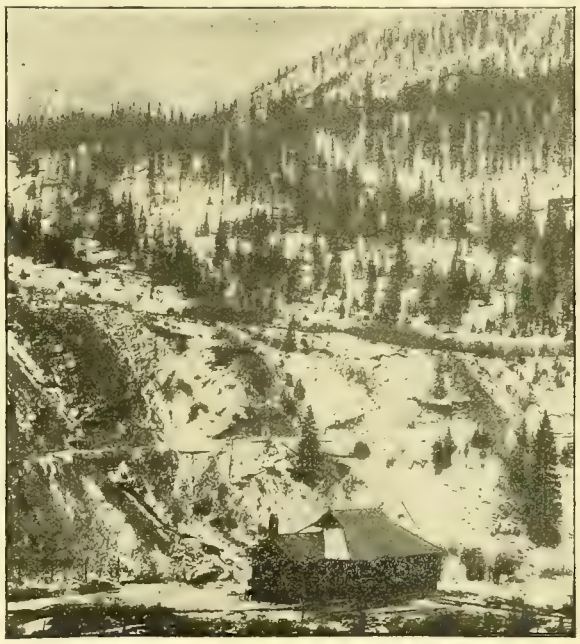
MR. MCMYNN: The Peck boiler is a new boiler in the market, and in the Detroit municipal works is showing very good results. It has a very large drum; I think 84 inches, of half-inch steel; and on the bottom the bricks are secured, held directly on the shell, which stops the heat from striking the boiler itself. The bricks get red hot and they are imparting their heat to the shell, and they produce a high temperature where the gas enters the tubes. If you can complete the combustion before you get the gases into the tubes you will get a much higher temperature. You will do better than if they were thrown directly into the flues with the smoke. Smoke is only an absence of oxygen, and as soon as you get complete combustion you will get a very high temperature.

## First Three-phase Plant in the Rocky Mountain Region.

An important application of the three-phase system of long-distance transmission of power has recently been installed and put in operation at the Silver Lake mines, near Silverton, Colo., where power is transmitted a distance of three miles through some of the roughest country in Colorado. It is attracting considerable attention among mining men, as it is the first three-phase plant installed in the Rocky Mountain region.

The Silver Lake group of mines lies about four miles southeast of Silverton, at an altitude of 12,300 feet above sea level. They are owned by Edward G. Stoiber. The ore mined carries both gold and silver, is of a comparatively low grade and requires concentration.





FIGS. 2 AND 3. FIRST THREE-PHASE PLANT IN THE ROCKY MOUNTAIN REGION.

Previous to the installation of the electric plant, the mill, which is situated on the shores of the lake, near the mouth of the mine tunnel, was run by steam. Coal was brought to the steam engine by the zig-zag path up the mountain shown in Fig. 1, and by the time it reached the furnace it cost $8.75 a ton. This represented a monthly expenditure of almost $1,000, and the expense proved a burden which went far to eat up the profits of the mine.

The plant is now operated by water power, which is brought from the Animas river, above Silverton, through a three by four foot flume 9,750 feet in length, which carries 2,350 cubic feet of water per minute. Flume and trestle are shown in Figs. 2 and 3. One of the great advantages of electrical utilization is here demonstrated, for it was found less expensive to build this costly two-mile flume, running from above Silverton down to a spot where the necessary head could be utilized, and then to transmit the current back to the mine, rather than to continue to burn coal at the price which it brought at the mouth of the Silver Lake mines. The head of water obtained is about 180 feet; this develops on the water-wheel shaft 640 horse power. The plant consists of two four foot double-nozzle Pelton water wheels, wheels with special buckets belt-connected to two 150 kilowatt General Electric three-phase generators. The current from these machines is given out at 2,500 volts and is transmitted over a distance of a little more than three miles to the Silver Lake mill and mine. The conductors are No. 3 B. & S. bare copper wires, one for each branch of the three-phase circuits. These are strung from the power house, shown in Fig. 3, up the mountain passes and through the rugged, forbidding country shown in the illustrations. In one place where a chasm has to be spanned the wires leap from pole to pole a distance of 275 feet. They have been strung with special care as befitted the abnormal conditions. At each insulator the wire is run through a short piece of rubber tube as an extra precaution against leakage. Lightning arresters are placed at each end of the line and an additional safeguard against possible damage by lightning is provided in the shape of a barbed iron wire which extends the entire distance of the line along the tops of the poles and is grounded at every second pole. In this country where the storms are frequent and the lightning disastrous in its effects, every precaution is taken to frustrate possible damage from atmospheric discharges.

In the winter time the snow lies thickly on the ground and all intercourse between the mine and civilization is almost cut off. Some idea of the difficulties of the road may be gathered by referring to Fig. 1, where the zigzag route up the side of the mountain is shown.

Arriving at the mine the current is supplied to a 100 horse power three-phase induction motor run directly from the primary circuit. Another 100 horse power motor, as well as one of 75 horse power, is located beneath the ground, and current is supplied to these at a pressure of 220 volts, the reduction in pressure being effected by step-down transformers. In addition a 15 horse power motor runs a pump raising water from the lake to the mill, and one small one horse power motor operates a blower and the lights for a bunk, office and other buildings, both being connected to the secondaries.

The induction motor used is an excellent representation of the latest type of alternating current motor built by the General Electric company, as will be seen by the cut, Fig. 4. There are no commutators, collector rings or brushes. The field winding is connected to the circuit, but there is no connection between the armature and any external source of current. The three-phase currents rising and falling in the field windings induce corresponding current in the armature winding and the armature revolves. The field armature cores are so completely laminated that all loss from eddy currents is practically eliminated. The speed of the motor is at all loads practically constant. The starting resistance for preventing any excessive current in the armature winding while gaining speed is contained in the armature itself, and the handle shown in the illustration serves to cut out the resistance when the motor is fully up to speed. These induction motors are built to stand the severest conditions met with in actual service.

The interest in this mine centers, of course, upon the economy induced by the electrical installation. The power used in the mill and the mines at the present time is more than three times as much as was used when generated by the steam engine previously employed. If, therefore, $1,000 a month or $12,000 per year would be economized by using the same power, an economy of not less than $36,000 a year is effected by the operation of the mine by electricity, and a greater power is available. Another advantage is that the operation of machinery inside the mine is made possible for the first time.

The second annual meeting of the American Society of Municipal Improvements will be held in Cincinnati on September 11th, 12th and 13th.

## Humorous Side of an Exposition.

It is not so long since the exposition of '93 that the readers of the WESTERN ELECTRICIAN have entirely forgotten the strange, impossible and laughable propositions which were laid in all seriousness before the management, or published in the daily papers. There was the man who had a project for lighting by means of a copper and a zinc plate buried in the earth, and the individual who wanted to light up a section of a building by static discharges, and the inventor who was going to startle the world with a system of shifting the current rapidly through a series of incandescent lamps, and thus make the current required for one lamp do service for a dozen; and a lot of inventors of this class who expected to lift themselves over the fence by their bootstraps. There was to be a veritable iron mine under the Lake Front park and a grotto with a glass roof beneath Lake Michigan, if suggestions were only adopted. Equally feasible were hundreds of propositions, inventions and suggestions which the directors and managers of the Columbian Exposition were too obtuse to take stock in or assist to develop. The world, alas! has lost the suggestions of these people, who were so unfortunate as to be born ahead of the age, and the value of their irrecoverable discoveries, inventions and suggestions may never be calculated.

But there is a lesson in all this. Another huge exposition is about to be brought forth, and it remains to be seen if the management, having these dire mistakes of our own exposition before it as an example, will accept and profit by the suggestions which are gratuitously showered down upon it by these minds of the future. One of these wise-beyond-his-days people has proposed that during the exposition of 1900 a congress be called to perfect several inventions (!), such as seeing at a distance, photographing in colors, directing balloons, electric lighting without lamps, by "the cold light process" through the aid of waves of high frequency. If the reader guesses that this last is Dr. Gibbons, who claims to be the discoverer of the fact that electricity is cold, and not hot, he is mistaken. This "inventor" is a Frenchman. Another proposes a luminous fountain 1,000 feet high, or a luminous cataract falling from the third platform of the Eiffel tower. One suggests that the entire Champs de Mars and the buildings of the exposition be lighted by a single electric sun. There are plenty more electrical suggestions, but other branches of wisdom have a showing as well.

One gentleman suggests the construction of a grand imitation of a volcano, within which will be found all the industries with which fire is connected as a principal agent in construction or reduction of metals, ores, etc. Another desires to have a huge globe placed between the second and third platforms of the Eiffel tower, and in this world he would place the many special exhibits of the nations of the earth. A mountain, 100 meters higher than the Eiffel tower, containing a restaurant, a café and theater on its summit, is another sage proposition, and a tower of Babel on the right bank of the Seine, opposite the Eiffel, with a captive balloon to transport passengers between the two, is another.

It is to be hoped that the management of the French exposition will make haste slowly before rejecting these valuable suggestions.

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ENGLAND'S willingness to give up all claim to the ownership of the little island of Trinidad, off the Brazilian coast, providing she can be allowed to use it as a landing place for a telegraph, leads the New York *Sun* to remark that no doubt she would have liked to make a similar concession regarding Necker Island or French Frigate Shoal, in the Hawaiian group. The first question is as to who owns Trinidad, and then comes the inquiry as to what the owner wishes to do with it. It would do no harm to exercise a degree of watchfulness over these transactions. A landing place for England's telegraph at Trinidad means British supremacy eventually, unless prevented by outside interference. What's the matter with our own government exercising a general supervision over the telegraphic connections of the new world?

IT is not to be wondered at that the people of Evanston, Ill., are enraged over the vandalism that has been practiced by employes of the lighting and telephone companies. The beautiful shade trees which form one of the most attractive features of that city have been mutilated and disfigured until they are positively hideous in some instances. In many cases it would have been very easy for the companies to have strung their wires without interfering with the shade trees in any way, and in some instances it would seem as if the companies deliberately went out of their way to increase the annoyance and inflict more damage. It is no wonder, then, we say, that the people protest against this outrageous conduct, and demand that hereafter all wires shall be placed underground. It is simply out of the question to defend the course of these electrical companies at Evanston.

STREET lighting in small cities and large villages presents many problems unknown to the managers of stations in larger communities. The subject was considered at the last meeting of the Northwestern Electrical association, which was held in Chicago, and the views expressed by the members on that occasion as reported in this journal last week indicated that there was considerable difference of opinion on several points. There seems to be a preference for incandescent lights, especially where there are a good many shade trees, as is usually the case in smaller places. The discussion should be of interest to central station managers whether or not they are members of the association. The subject is by no means exhausted and suggestions resulting from actual experience of other managers will no doubt be acceptable to all who are giving thought to the solution of the problem.

IT is true that much remains to be done in improving steam practice in central station work, and Mr. McMynn's paper, which is presented on another page of this issue, contains several excellent suggestions in this line. Practical men will recognize at once the importance of giving this subject more attention than has heretofore been bestowed upon it. Generally speaking, the history of boiler equipments is the same old story, another chapter in the development of electric plants like the experience with engines and dynamos. The only way to reach a satisfactory solution is by employing experts in boiler making. Such an important part of the station equipment should not be left entirely to the honesty and intelligence of the boilermaker. He may be dishonest, careless or incompetent, and in any event, if he is relied upon entirely, there is a probability that there will be serions defects in design or construction. Mr. McMynn's experience and standing in his profession lend weight to his opinions and suggestions.

IN street railway circles it is conceded that Charles T. Yerkes is not only a successful manager of street railway properties, but that he is conservative as well. Ever ready to take advantage of improvements that promise to enhance the value of the securities of his companies, he is not, however, given to building castles in the air. The value of an invention or improvement is measured by him in its ability to increase the net earnings of his railways. The Chicago street railway magnate has found in the overhead trolley system a most valuable auxiliary to his cable trunk lines, and his advocacy of electricity is due entirely to his belief in its dividend-earning capacity. The introduction of the trolley on the lines of the North and West Chicago street railroads formerly operated by horses was an important recommendation for the electric motor, and the announcement of the result of this transformation, its effect upon the receipts and expenditures of the companies, is gratifying to all who are interested in this method of propulsion. In an interview presented in another column this week Mr. Yerkes gives his reasons for advocating the trolley system and he explains the relations of the cable companies to the auxiliary electric companies. He says that as soon as a line is equipped electrically the traffic increases and that those lines now operated by electricity show an improvement of 30 per cent. The net earnings for seven months of operation by electricity showed an increase of 24 per cent. as compared with the corresponding months of last year. "While we have hauled more people than we did a year ago, the operating expenses have been less," said Mr. Yerkes. The interview quoted will be found to contain much information about the street railway lines of Chicago.

SOME of Chicago's daily papers are working themselves into a frenzy over the discovery that "the insane asylum at Dunning is in imminent danger of fire." This is the introductory sentence to the latest sensation that has been sprung on the public in connection with the institution now under investigation. Of course the reporter who wrote up the story knew nothing about the subject, but that did not prevent him from deciding off-hand that the inmates of the asylum would be burned up some night, and that the cause of the fire would be "electric wires." Undoubtedly there have been grave abuses at Dunning, and the electrical equipment of the institution, installed ten years ago, may have been allowed to deteriorate, but those who are interested in raising the standard of the asylum should not endanger their cause by placing it in the hands of such reckless advocates as the young man who wrote up the description of the lighting plant. Why not proceed in a calm, judicious manner? It is quite probable that an intelligent investigation would disclose facts that would warrant the county commissioners in ordering a complete reconstruction of the electrical plant. It is safe to assume that any electric plant operated by public servants for ten years will be about ready for the scrap heap. Those familiar with this installation say that at the time the institution was provided with electric lights, the wiring was passed by a competent inspector, and that there is no doubt that the work was well done. But since that time it has had plenty of opportunity to deteriorate, and it would not be surprising if the entire plant needed overhauling. But to return to the original idea. There is no excuse for the sensational yarn published in the Chicago papers last week. It is a disgrace to legitimate journalism and an insult to the intelligence of the readers of these papers.

WORD was received in this country last week that on August 12th President Dole, of the Hawaiian republic, laid before both Houses of the Legislature the contract made with Z. S. Spaulding to grant a subsidy and exclusive franchise in return for laying and operating a cable from San Francisco to Honolulu. The only material change was a reduction of the annual subsidy from $50,000 to $40,000. The Senate appointed a committee to confer with the Chamber of Commerce and ascertain the views of the merchants. The conference was held on the morning of the 13th, lasting nearly two hours. The chamber voted 20 to three in favor of ratification by the Legislature of the contract. In the afternoon the Senate passed the joint resolution ratifying the contract of the government with Spaulding, only one senator dissenting. The representatives followed also with a similar vote. Col. Spaulding has, therefore, secured a fully ratified contract with Hawaii, and is ready to apply to the coming session of Congress for needed aid. An appropriation of $250,000 will be asked, and it is believed that the new Congress will consider the subject much more favorably than did the last. Early consideration of this subject is demanded. Some measure should be adopted providing for telegraphic communication with Honolulu.

Two methods of avoiding or overcoming electrical interference were discussed by Mr. Abbott in his paper before the Northwestern Electrical association at Chicago; namely, complete metallic circuits, and the introduction of special return feeds from dangerous points. In his paper on "Additional Solutions of the Electrolytic Problem," which will be found on another page this week, Mr. Abbott further considers this important subject. First of all he disposes of the suggestion that corrosion could be avoided by operating the railway circuit as a three-wire system, pointing out, first, that a double track is essential, so that the trolley wires may serve as the outer mains, while the ground and the rails play the part of the neutral wire. Of course, this of itself would make the expedient unsatisfactory, as it would exclude all of the many single-track installations from consideration. Another objection is that it would be impracticable to arrange the load on the two sides of the railway to a complete balance, and in so far as the system is out of balance the current must return through the rails and ground. Besides, as the load on the two sides of the system is constantly varying over the entire length of the road, the current in the neutral conductor will correspondingly vary, and will in this way spread the injury to underground structures over a much larger territory, and render it impracticable at any time to determine where injury is about to take place. Mr. Abbott considers Mr. Brown's arrangement of station machinery a partial solution of the problem and the chief features of this plan are carefully described and illustrated in this week's contribution, but he does not look upon it as a complete cure. The plan proposed by Mr. Farnham, which is also described, is accepted with favor by Mr. Abbott, but he does not hesitate to show his belief that it will be rejected by railway companies, owing to the expense which the system entails. He reminds the managers of railway companies, however, that it merely remains for them to face the inevitable position that they must either design railway lines in such a manner as to obviate the damage to existing underground structures, or to go out of the business. In conclusion he points out that it is absolutely certain that the time is rapidly approaching, if not already at hand, when no franchises will be granted to electric railway companies that do not contain a provision fixing upon the railway companies all responsibility for injury which may later be attributable to electrolytic action. He reminds them that in many instances the damage done by existing railway companies has formed a basis for legal proceedings, in every instance to the defeat of the railway company, and he admonishes them to look the situation squarely in the face and take such steps as in the future will relieve them from disagreeable responsibilities of this kind. It should be remembered that this advice is offered by a man whose experience has been gained in a large measure with railway companies, and although he is at present engaged in telephony, his utterances show that he is fully alive to the value of the railway companies' claims. His personal view is that both systems should be so constructed as not to interfere in any way with the property of others. He concedes to the telephone companies no privileges or advantages not enjoyed by the railways, and he insists that responsibility for damages be placed wherever it belongs.

## Telephone News from the Northwest.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

The telephone war in Sioux City, Iowa, continues. The city has ordered out all Iowa Union instruments formerly used by the municipal departments. The Home Telephone company says it is increasing the number of subscribers daily, and the Iowa Union modestly admits the same thing. A. F. Cutter, general manager of the Iowa Union company, has issued a circular letter to the patrons of the company in Sioux City, assuring them that the company will give service at the lowest rates compatible with good service, and explaining the recent reduction (soon after a competing company entered the field) on the ground that some of the patents used by the company had expired. The Iowa Union Telephone company is about to put in metallic circuits at Oskaloosa, Iowa, doing away with the ground return. The new companies which are rapidly covering the state are using the metallic circuit.

A telephone exchange will probably be established in Mitchell, S. D., shortly, as the recently formed company is receiving considerable encouragement.

The mayor of Madison, Wis., vetoed the franchise granted the Standard Telephone company because it did not require the wires to be placed underground when ordered by the council, nor did it give the use of the company's poles to other companies nor agree to lower the poles when the grade of the street is changed. A new franchise embodying these points was drawn up and will be considered. No serious objection will probably be taken except to the underground order, which places the new company at a disadvantage.

The Western Telephone company of Iowa Falls, Iowa, is ambitious. It now owns 200 miles of line in the northern part of the state and controls nearly 1,000 miles of leased wire in Iowa and Minnesota. Work is being pushed on other lines and the company hopes to have 1,000 miles of its own wire completed by spring. The company intends to go west to Sioux City or Sioux Falls, east to Chicago and north to Minneapolis and St. Paul.

The Northwestern Telephone Exchange has completed a long-distance line to Galesville and Centerville, Wis.

Buffalo Center, Iowa, wants telephone connection from Germania to connect with the main line at Bancroft.

Geo. V. Bandy has secured a franchise for a telephone exchange at Perry, Iowa.

The Northwestern Telephone Exchange will not string wires across the bridge over the Mississippi river, but will instead lay a cable across the bed of the river.

The Saugatuck & Ganges Telephone company will build a line between Saugatuck and Ganges, Mich., via Douglass.

The Northwestern Telephone & Electric company of Milwaukee is an applicant for a telephone franchise at Racine, Wis. The company has secured 150 subscribers.

J. P. Rice and H. M. Sowle have been granted a franchise for building a telephone line through Sparta, Wis., and it is understood that a toll line will be built from Sparta to Tomah.

The Western Telephone Construction company has made a proposition to the Tri-city Telephone company of Clinton, Ia., to put in a telephone exchange.

The telephone company at Cedar Rapids, Ia., has given the city a lower rate for police telephones this year than last, though it refused to do so at first. Later the manager wrote to headquarters for instructions, with the result stated

The Northwestern Texephone Exchange is considering putting in an additional exchange at Selby avenue and Dale street, St. Paul.

Telephone connection will soon be completed between Winona, Minn., and Eau Claire, Wis.

V. H. Stevens will extend his telephone system from Rossville, Ia., to Waukon and Lansing, Ia., and will have it in operation in six weeks.

The Western Electric Telephone company of Britt, Ia., is working in Southern Minnesota towns, including Grand Meadow, Austin, etc., to extend its line.

The Northfield, Minn., school board has decided to put telephones in the school houses.

Fairmont, Minn., has given a franchise for a telephone system to the Northwest Engineering company of St. Paul, and work will begin very soon.

The Iowa Union Telephone company has reduced rates to the Vinton, Ia., exchange.

The Wausau Telephone company of Wausau, Wis., has ordered instruments from the Standard Telephone company of Madison, Wis., and Menomonie, Wis., has ordered 125 telephones from the same company. Gen. A. C. Parkinson and John Lamont of Madison, Wis., have secured the right from this company to sell its product in Washington, Oregon and California, and have gone to Portland, Ore., which will be their headquarters.

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Earl P. Hopkins of Nashua, Iowa, has been granted a franchise for an electric plant by the council of that place.

## Street Railway Business in Chicago.

An interesting interview with Charles T. Yerkes, published in the Chicago daily papers and reproduced here, gives an excellent idea of the present condition of street railway business in Chicago. "The street railway companies are doing fully as well as we expected," said President Yerkes. "As soon as a line is equipped with electricity the traffic jumps immediately. Those lines we are now operating by electricity show an average increase in gross traffic of about 30 per cent. I have before me the figures which have just been prepared showing the net earnings of the West Chicago cable system for the seven months ending with July. The net earnings of the road for these seven months show an increase of 24 per cent. as compared with the net earnings for the same months of 1894. I should judge the comparison for the remaining five months will be more favorable than that, for we will for the remaining five months receive greater benefit from the electric lines. We have been greatly disappointed in getting the electric equipment into operation on the West Side. The trouble was entirely with the single contractor who was to furnish rails and fish plates. After repeated delays we were forced to take the contract elsewhere. The work will now be rapidly completed. The increase in net earnings comes both from an increase in traffic and a decrease in expenses. While we have hauled more people than we did a year ago the operating expenses have been less.

"The outlying electric lines are doing remarkably well. The North Shore Electric is earning the interest on its bonds and the guaranteed dividend on the stock. The lines of the North Chicago Electric and the Chicago Electric Transit are doing an exceedingly profitable business. Here are the statistics for one Sunday. They show those lines made average earnings a car running from $27 to $42. The Milwaukee avenue line earned $42 a car. Of course, it must be remembered that those figures are for a Sunday and are exceptional."

A question which has been much discussed in financial circles is in regard to the ownership of the stock in the various auxiliary electric companies. Some of the holders of North Chicago and West Chicago cable securities have believed these stocks were held in trust in some way for the benefit of the cable companies. Mr. Yerkes was asked if that is the case.

"No," said Mr. Yerkes; "none of the stocks of the auxiliary companies are owned by the cable companies. In fact, it would not be lawful for the cable companies to own them. Some special legislation would be necessary before that could be done. In any event that is not the plan. Those stocks will eventually come on the market. A small amount is now in outside hands, it having been given to people in securing right of way and for other purposes. I am, of course, a large holder of those stocks. In due time, when the properties are more fully developed, those stocks will come on the market and will be actively traded in. Just when that will be I cannot now say. They will be good stocks, however, and their value depends only on the question of whether Chicago is to continue to grow. The Chicago Electric Transit company has an exceedingly valuable franchise. It has the right to build over forty miles of road, and all of it through a rapidly developing country. These outlying electric lines are to be greatly developed. The end of their development is by no means in sight.

"The North Chicago Cable company is having an even more prosperous year than the West Chicago. All the extensions and new electric equipment are being paid for out of the net earnings. The electric lines are showing heavy gains. The business of the State street line is 30 per cent. greater than before the trolley cars were put on and the expenses of operation much less. I am inclined to think the increase draws somewhat from the Clark street cable, although that line continues to make favorable comparison with business before the State street trolley started."

It has been generally understood that it is planned to bring the electric cars from the North Shore Electric, North Chicago Electric, and the Chicago Electric Transit companies down to the city over the tracks of the Northwestern Elevated. That supposition has raised the question as to the value of those feeders under such circumstances to the North Chicago and West Chicago cable systems, and consequently the question of where those cable companies are to receive any return for guaranteeing the bonds of the electric companies. Mr. Yerkes was asked what there was to say on that phase of the situation.

"I cannot say myself just what cars will be brought down over the Northwestern Elevated and what will come down over the cable lines. We are developing this entire territory, not with a view to any one road or company, but with a view to the entire system, and traffic will be sent in the direction which seems best to send it, having reference only to the entire system. The Milwaukee avenue line, I should say, will always be tributary to the West Chicago cable. A portion of the North Shore Electric traffic will probably always come down over the North Side cable. In the management of the various properties, however, we are constantly looking at the system as a whole. The Lake Street Elevated, for instance, is to be operated by electricity. That portion of the road lying west of the river will draw its power from the West Chicago Street Railway company's power house. The portion east of the river will receive electricity from the North Chicago Street railway power house, because we calculate that it will be cheaper than bringing it from the Western avenue station. The North Chicago lines will in some cases be operated from the Chicago Electric Transit power houses, while in turn some of the Chicago Electric Transit cars will be moved with electricity from the North Chicago Electric power house. The most economical operation, looking at the system as a whole, is what we are aiming at.

"Yes; the Lake Street Elevated road will be put on its feet. The reports that it has been earning the interest on the scaled bonds are not correct. It did just about do that last month, and will make earnings sufficient to pay that interest for the remaining months of this year, I think. But the earnings for the whole year will not show the interest earned. The road will, in the future, earn its fixed charges. We will look out for that. But whether it will earn anything on the stock I cannot say."

In spite of this definite and straightforward statement in regard to the ownership of the stock of the auxiliary electric companies, there continues to be some misunderstanding on that subject. Indeed, the statement has been made that in spite of what Mr. Yerkes said in that interview it will ultimately be found that the stocks of these various electric companies are, after all, held in trust in some way for the benefit of the stockholders of the North Chicago and West Chicago Cable companies. Mr. Yerkes was asked to make a statement definite enough to set at rest any possible question regarding the status of those stocks.

"The stocks in these electric companies are owned absolutely by myself and a number of other people," Mr. Yerkes said. "They are not held in trust for the North Side and West Side Street Railroad companies nor for the benefit of the stockholders in those companies. There is to be no distribution of them. There is no reason there should be. There is no sort of outside connection, no sort of 'string' tied to the ownership of those stocks. The people who have thought the stocks are held for the benefit of the cable companies or the cable stockholders evidently misunderstand the situation. I understand that in some quarters it has been said the money to build these electric lines was advanced by the cable companies. If that were true of course the cable companies should have an interest. It is not true, however. Every dollar of money to build these lines has been advanced by the people who are interested in these stocks. The cable companies have guaranteed the bonds, as they might have guaranteed the bonds of any other entirely independent organization which was in a position to bring them traffic.

"It has been a theory of mine, and one which experience in the street railway business has steadily emphasized, that you can carry a passenger about so far for five cents and no farther. People used to come to me repeatedly asking me to build extensions, and I steadily refused. I told them they might build the extensions and we would be glad to haul the traffic down-town. After a while some people got together and organized the North Shore Electric at a time when I was in Europe. When I got back and found how strong the people behind the enterprise were and found they wanted to make an arrangement for the interchange of traffic which would permit them to run their cars over our tracks to the business center, I of course declined. It set me thinking, and I saw there might be danger in making such contracts with companies that might not always be friendly. I saw that these outlying roads must be built and I made up my mind that it would be a good thing for me to do to build them and a good thing for the cable companies to have them built and managed by friendly hands; that is what has been done. I secured control of the North Shore enterprise and then made a traffic contract between the two companies which has been of much benefit to the cable stockholders. We advanced the money to build the other electric roads and naturally hold the stock. There need be no misunderstanding about this situation."

Here is a statement that is definite, straightforward and convincing. Mr. Yerkes is evidently not juggling with words and means exactly what he says. People interested in the situation can accept as official the statement that these stocks are owned absolutely, owned independently of any outside connection, by Mr. Yerkes and the others who have been associated with him in advancing the money and building the lines.

"The North Chicago Electric was the only one organized by our parties. All the other companies were organized by others and we bought them out."

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## Long-distance Transmission Plant at Fresno, Cal.

An interesting long-distance power transmission plant is in course of construction at Fresno, Cal., which is unique in more than one particular. The head of water to be used is 1,410 feet, and the distance of transmission about 35 miles. The water for supplying the power is taken from the North Fork of the San Joaquin river, which runs for several miles down a rocky canyon, forming rapids and cataracts as it runs between the steep mountains. At the head of the rapids a canal will take the water out upon the summit of a high ridge, which it will follow for six miles to a point nearly 1,500 feet above the San Joaquin river. Here a reservoir has been constructed with an average depth of 10 feet. It covers about eight acres, and can be made larger and deeper should the demand for power require an extension. Into this reservoir the water brought along the ridge by the canal will be stored, but it will be used solely on emergency. It is calculated that it will hold enough water to drive the machinery for several days, so that, should a break occur between the reservoir and the source of supply, the electrical work could continue until the repair was effected. A pipe line runs directly from the canal, a distance of about 4,000 feet, to the power house, and the head of water obtained will not be less than 1,410 feet. The pressure at the bottom will be 600 pounds to the square inch. The lower end of the pipe line is of welded steel pipe, three-quarters of an inch in thickness, having special steel flanges and special packing at the joints. The lowest amount of water power available is at least 7,000 horse power at the head already mentioned. Should a break occur near the lower end of the pipe the rush of water would form a vacuum near the upper portion of the pipe, and it might collapse under atmospheric pressure. An air valve will be placed near the top to provide against this contingency. The pipes will be made in sections of 20 feet each. At the upper end the metal will be one-quarter inch

[illegible] 24 inches in diameter. It will be fastened to the solid granite mountain sides by steel cables.

The power station will be located at the bottom of the mountain, and will contain three Pelton water wheels 58 [illegible] driven by a single nozzle. The generating plant will consist of three 340 kilowatt General Electric three-phase generators. From the point in the North Fork of the San Joaquin river where the water is taken to the power house at the foot of the mountain is a distance of about seven miles. From the power house to Fresno, where the electricity will be utilized, is about 31½ miles in a direct line, or 35 miles over the electric wires. The line will consist of two circuits of bare copper wire, consisting of six wires strung on poles 40 feet high. The current will be delivered to the lines at a voltage of 11,000 volts. From the power house the line will rise to the level of the San Joaquin, cross it and pass through a portion of the Auberry Valley, then rising over the Red Mountain, passing about a mile west of Clovis, will continue direct on to Fresno. The first five miles will be over moderately level country, the other 30 through an open and practically level country under ideal conditions for transmission. It is estimated that the power which will be delivered in Fresno at present from the three-phase generators will not be less than 900 horse power.

At the Fresno end the line will be brought into a sub-station and the current will be transformed down. From the sub-station power will be delivered to all the mills in town, the water works, machine shops, planing mills, laundries, printing presses, elevators and packing houses. It will also be used to drive the street railway system of the city, which will require about 300 horse power. In the sub-station, two arc dynamos, each of 60 lamps capacity, will be driven by an induction motor, the motor being mounted on the same bedplate as, and being directly connected to, the dynamo. Current will be supplied for 4,400 incandescent lamps.

Gas and fuel in the San Joaquin Valley have always brought an extremely high price, and this may be considered as the most potent reason for the present installation. It is believed that power can be supplied when the plant is started at about half its present cost; and to the towns around Fresno the privileges of electricity will probably be extended as soon as possible.

## American Electrical Works and the Manufacture of Insulated Wire.

No better evidence of the rapid development of the business of manufacturing wire could be found than that presented in the growth of the American Electrical Works, whose twenty-fifth anniversary was commented upon in the last issue of this journal. Since the inception of this enterprise its progress has been really remarkable. In 1870 the foundation of this concern was laid in the establishment of a plant for the manufacture of insulated wire on a small scale in Providence. An idea of the limited facilities at hand at that time can be gained by a glance at the sketch of the building in which this beginning was made. The cut, Fig. 1, is a reproduction of a "poker painting" by C. Wesley Field, who presented it to Eugene F. Phillips. The illustration is an "impression picture" of the old barn in the rear of 57 Chester street, Providence, where Mr. Phillips first engaged in the manufacture of insulated wire. At the start only 30 pounds of copper was used in a day, but it can be easily understood that the business did not continue on this small scale very long. It required great energy and executive ability to keep up with the demand as soon as the electric light and railway began to develop. To-day the equipment is complete in every particular. The works are located at Phillipsville, R. I., two miles from Providence, on the Pawtucket river.

In striking contrast to the first site is the present plant, shown in Fig. 2. The new factory contains about 2½ acres of floor space, and is surrounded by about 28 acres of ground. The company has a boarding house for its employes, a grocery store, and practically maintains the whole village. About 700 hands out of a capacity of about 1,000 are at present employed, and work is being carried on 20 hours out of the 24. The capital of the company is now $750,000, and it uses about three carloads or about 75,000 pounds of copper bars a day. The introduction of rolling and drawing mills enables the company to handle

FIG. 1. AMERICAN ELECTRICAL WORKS AND THE MANUFACTURE OF INSULATED WIRE.—FIRST FACTORY IN PROVIDENCE, 1870.

the copper just as it comes from the lake in ingots, rolling it first into long rods about three-eighths of an inch in diameter, and then drawing it to any desired size from No. 0000 solid down to wires as small as one and one-half one-thousandths of an inch. The factory is lighted by three 250 light incandescent dynamos, and one 35 arc light machine, and has a 250 horse power generator for parts of the factory.

If the history of the corporation that has accomplished these results is interesting, that of the individuals under whose direction the enterprise was nourished and developed must be equally impressive. Little need be said of the founder and guiding spirit of this great enterprise. Eugene F. Phillips can boast of a greater personal acquaintance with members of the electrical fraternity than any other man in the business. He has been actively engaged in it for 25 years, and being of an affable, cheery disposition and always ready to lend a helping hand to his less fortunate fellows, he has naturally a considerable personal following more in the nature of intimate friends than business acquaintances. He has been successful in his business ventures far beyond his own early expectations, but there is not a man in the electrical business to-day who will say that he has not fully merited this reward.

Another prominent figure in the development of this industry is W. A. Hathaway, who became connected as a clerk with Eugene F. Phillips on February 1, 1883. From this position he has progressed as the result of his attention to business until, in 1891, he was elected treasurer of the American Electrical Works. This position of honor was given only when his efforts deserved this recognition. During the last two years Treasurer Hathaway has guided this concern from all financial breakers.

W. H. Sawyer, who began his services with Eugene F. Phillips January 1, 1878, as superintendent, has also been rewarded for his faithful attention. He remained in control of the factory until 1882, when he was elected secretary of the American Electrical Works, which position he has since held, discharging the duties of the office with honor to himself and credit to the company.

C. R. Remington, Jr., after a clerkship of only a year, was elected assistant secretary of the American Electrical Works in October, 1894. He is one of the rising young men of the electrical business.

P. C. Ackerman became associated with the American Electrical Works May 1, 1887, succeeding H. Hall in charge of the New York office of the company. He was for three years previously in charge of the Boston office of Holmes, Booth & Haydens. When he assumed his duties at New York the office was doing a local business only, but under Mr. Ackerman's management it became the general office for all business in the central and western states as far as the Pacific coast, up to the time of the opening of the Chicago office in June, 1894. Mr. Ackerman is known as one of the most successful and popular salesmen in this line of business. His friends have been gained by fair treatment and good business methods. The business under his care has grown to large proportions, the success attained being deservedly his from a constant attention and careful business management.

F. E. Donohue assumed charge of the Chicago office of the American Electrical Works in June, 1894, having formerly been connected with the United States Wire & Cable company and the New York Safety Insulated Wire company of New York, with which his business success is well known to the electrical trade. He took hold of the affairs in the West with his accustomed push and energy and soon had a line of general business which was very satisfactory. His success has been marked and thoroughly in keeping with the record of the company he represented. He has clearly demonstrated his ability in this field and is regarded as the right man in the right place.

Everything considered, the marvelous growth of the American Electrical Works is easily explained. With such an admirable executive at the head of the company, surrounded by capable and devoted assistants who realized that their interests were identical with those of the company, it is not at all strange that in 25 years the great industry already described should have been developed from the humble beginning at 57 Chestnut street, Providence, in 1870.

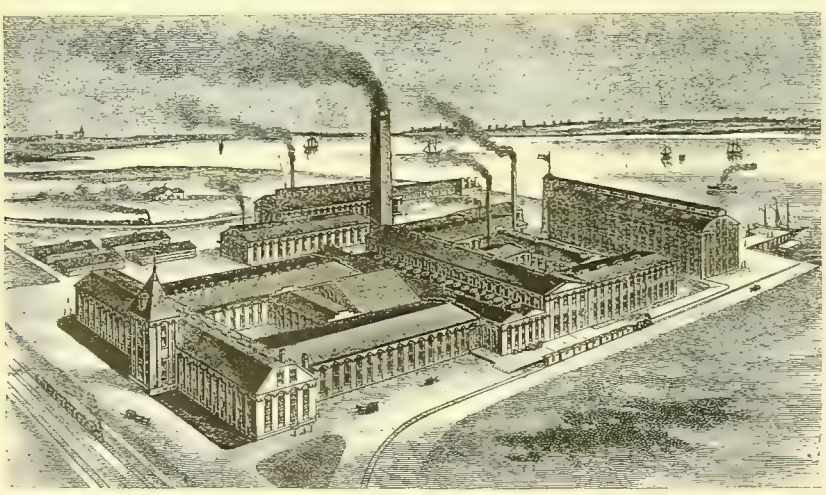


FIG. 2. AMERICAN ELECTRICAL WORKS AND THE MANUFACTURE OF INSULATED WIRE.—PRESENT FACTORY AT PHILLIPSVILLE, R. I.

## Promising Outlook for Acetylene.

[From the *Chicago Tribune.*]

The latest published report of the Ontario Bureau of Mines contains a great amount of information about the gas acetylene, which is expected to come into use as an illuminant. The report states that the process for the economic production of calcium carbide and acetylene is the most promising discovery that has been made in recent years for the supply of light and fuel, though "experiments" on the enrichment value of the gas, made by Prof. Lewes, have convinced him that acetylene will be of no practical use to the gas manufacturer as an enrichment of gas in bulk, other processes being cheaper. The inventor, Thomas Leopold Willson, is a Canadian. He does not claim to have discovered acetylene gas or the properties of the carbides. The materials used are common lime and carbon in any form—hard or soft coal, coal dust, charcoal, petroleum, tar or peat. These are treated in an electric furnace, and Mr. Willson is confident that where electricity can be generated with water power the cost of manufacturing calcium carbide brings it easily into competition with other materials of fuel and light. He says a plant erected near a great water power, like Niagara Falls, may supply the continent at a figure with which coal gas cannot compete. The power at Niagara is ample for almost any conceivable requirement, while it is alongside a mountain of limestone, and coal dust or culm can be had at little more than the cost of hauling from the mines of Pennsylvania and Ohio.

Arrangements already are being made to procure electrical energy for this purpose from the falls on both sides of the Niagara river from the company which controls the power franchises at the falls, so that it is probable the carbide soon will be manufactured on a commercial scale in Canada as well as in the United States. The carbide, containing 40 parts by weight of the element calcium, which is the basis of lime, and 24 parts by weight of carbon, will be cast direct from the electric furnaces into rods or cylindrical cartridges. One of those, 12 inches long and 1¼ inches in diameter, will weigh a pound and give five cubic feet of gas when subjected to the action of water, which is allowed to drip upon it slowly from a dropping tube. The oxygen of the water combines with the calcium of the carbide to form lime, while the hydrogen of the water unites with the carbon of the carbide to form acetylene. The latter burns with a luminous and intensely smoky flame when a light is applied to it, and when a mixture of one volume of acetylene and one volume of air is ignited in a cylinder a dull red flame is the result, with a dense black smoke and a mass of soot. When four volumes of the gas are mixed with five of

air the mixture begins to be slightly explosive, and the explosive violence reaches a maximum with about 12 volumes of air to one of the gas. From that point it decreases in violence till, when the proportion is 20 to one, the mixture ceases to be explosive.

Owing to its great richness the gas can be consumed only in flat flame burners. Under these conditions it emits a light greater than that of any other known gas. Its illuminating value, calculated to a consumption of five cubic feet per hour, is no less than 240 candles. Prof. Lewes told the British Society of Arts last January that the calcic carbide can be produced in the United States for about $20 per ton, and the beautifully pure lime obtained by the decomposition would be worth to the gas manager at least

W. A. HATHAWAY.

$2.50 per ton. The cost of the gas is figured out at 6s 4½d per 1,000 feet in English money, and probably this means English prices for labor. On this basis of computation the cost of a light of 20 candles' intensity would be 16 cents per hour.

The possibility of liquefying acetylene by moderate pressure permits enormous volumes of gas to be compressed into the liquid state in small wrought-iron or steel cylinders, from which it may be allowed to escape slowly through burners. This promises to make it of the greatest possible value for floating buoys and also for portable lamps where there is no ordinary gas supply. In this way it would take the place of the illuminating products of petroleum, and it thus may prove to be the very thing wanted to offset the exhaustion of oil fields within the next few years. In that event the value of the new discovery might be so great as to be beyond computation.

## What the Extension of Inter-urban Electric Lines Means.

[From the New York *Sun*.]

Moreover, the electric lines are gradually becoming continuous between large centers of population, running through town after town; and inevitably they will be consolidated in systems, which will make their competition with the steam roads still more serious, if those are not prepared to meet it by themselves making use of the electric

W. H. SAWYER.

motor. The railroad situation has been changed radically by the introduction of the new agent, and the railroads accordingly must adjust themselves to the novel conditions or suffer because of them.

## American Institute of Electrical Engineers.

A pamphlet has been prepared by the American Institute of Electrical Engineers to meet the demand for information regarding the work of the Institute and how to join it. The secretary will be pleased to send copies to all who may apply for them. The catalogue of membership which appears in this pamphlet is not brought down to date, the present membership being 950. The instructions for joining, however, were prepared especially for this purpose.

# CORRESPONDENCE.

## New York Notes.

NEW YORK, August 24.—It has been reported about town that Mayor Strong is opposed to the construction of an underground rapid transit road, principally owing to the cost of the work. The statement is, however, contradicted by the mayor, who had this to say in a recent interview: "I have not said anything to anyone which could be construed into opposition to the rapid transit plan. The only thing which I have said on the subject to which such a story could in any way be traced, is that I have gathered the idea from inquiries such as I often make among the people that underground transit is not altogether popular. Many people do not like the idea of traveling under the ground." "Have you thought of proposing a change in the plans?" he was asked. "No," said the mayor; "I have not considered any changes. There is no need to do so. I have been and am now in favor of the plan. I have been in full accord with the other commissioners." E. M. Shepard, counsel of the Rapid Transit board, says that the story that the commissioners will apply to the next Legislature for an increase of their appropriation to $100,000,000 is absolutely untrue and preposterous. The $55,000,000 already authorized is abundant, he says. Mr. Shepard added that the Rapid Transit Commission would be ready to make its first contract within a few weeks after the decision of the Court of Appeals is received, and that is expected about October 15th next.

On his return from Europe to-day, George Gould accorded the newspaper men an interesting interview. He had this to say concerning the probability of substituting electrical power for steam locomotives on the Manhattan

EUGENE F. PHILLIPS.

railway: "I cannot give you the precise situation until I have seen Col. Hain. I requested him to go to Chicago before I went away, and he has been there and examined the working of the electric locomotives in use there. He is going there again. No definite decision has yet been made by the Manhattan upon the question of substituting electricity. It is impossible to do so yet, because the practicability of using the electric locomotive for the Manhattan railway has not yet been demonstrated. I believe that electricity is the coming power for this purpose. As soon as it shall be demonstrated that it is a success for locomotives, our people will take the subject into definite consideration. Practically speaking, and as a matter of fact, the Manhattan railway is in a different position from almost all, if not all, other roads. We carry 600,000 people a day. We can run no risks; we cannot substitute one power for another as a mere experiment or a possible or even probable success. We must know absolutely that we can make the substitution successfully before we would be justified in undertaking it. It has been clearly demonstrated that electricity is a power that can be used for locomotives under certain conditions, but it has not been demonstrated that it is a power capable of handling 600,000 people a day without a hitch. If you will recall the trouble and delay which have resulted from slight causes in Manhattan railway travel, you will see what might happen with a system in which there was any unknown or uncertain factor. In this great city, whose great arteries of travel are north and south, and where congestion may so readily happen from stoppage of trains, we can make no experiments with the public in substituting one power for another."

It is announced that a 21-story building is to be built at Broad and New streets for the Commercial Cable company. The land and building will cost about $2,250,000, and the building will be ready for occupancy in a year and a half.

It is promised that another storage battery traction experiment will be tried on the Fourth and Madison avenue line. Six years ago a similar experiment was tried, but the results were not satisfactory enough to induce the New York and Harlem railway to adopt the cars. One car will now be put on the road, and if the success of it is great enough the company may adopt the system. It is said that the car will be of the standard type, but that the battery will not be carried in the car body, but suspended between the trucks under the car.

The New York Board of Fire Commissioners has now under consideration a plan for improving and extending the

C. R. REMINGTON, JR.

present system of fire alarms. If its efforts are successful the engines will hereafter reach a burning building so quickly that the flames will have had no time to gain great headway, and the men will have an even chance to deal with the blaze in its incipiency. The commissioners hope to accomplish this result by a more extensive use of auxiliary fire alarm boxes placed in private houses, factories, lumber yards, docks and the like. The system has been in use for years, but on a small scale only. This will save all the time that is now occupied in finding where the nearest fire box is situated and in getting there to turn in the alarm.

A *Herald* correspondent reports that two electric carriages are building in Camden, N. J., for the *Chicago Times-Herald* race from Chicago to Milwaukee in November. No names are given, but some rather strong claims are made for the vehicles, as will be seen by the following extract from the account: "They are being built of the best material, and will be in every sense first-class carriages of 'trap' pattern and are expected to cost about $1,500 complete for the two. This cost, however, can be regulated if the carriages do all that is promised for them, and they can be made in the future at almost any price. In any event, the first cost will be the

P. C. ACKERMAN.

only real one, because they are to be equipped with a storage battery which will run the vehicle 500 miles before requiring to be recharged, and this at a cost of but 13 cents for each 50 miles. A speed of 17 miles an hour is promised for the new invention, and some idea of what this means can be gained by a little comparison with an ordinary horse." W. F. C.

## New England News.

BOSTON, August 24.—The railroad commissioners recently sent out the following important decision in the matter of the heating of street railway cars:

"Under the provisions of chapter 136 of the Acts of 1895, entitled "An Act Relative to the Heating of the Street

Railway Cars," after notice to the several street railway companies and a public hearing of such as desired to be heard, and upon consideration by the board, it is determined and ordered that the following requirements and regulations be prescribed and notified to the several companies relative to the subject matter of the act:

"*Relative to the Heating of Street Railway Cars.*

"1. The several street railway companies shall equip such electric box cars as are used by them for the transportation of passengers in the months of November, December, January, February and March in each year with a suitable apparatus for heating the same by electricity; provided, that other than electric heaters may continue to be used in such cars as are now equipped therewith, until the further order of the board.

"2. Electric box cars, while in use for the purpose and during the months aforesaid, shall, whenever the outside temperature in less than 50° above zero, Fahrenheit, be kept warmed by such electric or other heaters to an inside temperature (as near as may be) of not less than 50° nor more than 60° above zero, except at times when the company is temporarily prevented from so doing by storms, accident or other controlling emergency.

"3. These regulations shall take effect on the first day of November, 1895, and may be modified from time to time in general or in particular, as experience and the public comfort may seem to the board to require."

The Union Electric Light company of Springfield, Mass., is to build a new power station at Indian Orchard. Preliminary plans for the building have been received and the directors have been authorized to negotiate bonds, and when issued contracts will be placed. The station is to have a capacity of 1,800 horse power, and the total cost will be about $100,000. It will probably be commenced early in the fall.

The Lowell & Suburban Street Railway company of Lowell, Mass., has made application to the commissioners for their approval of an issue of $400,000 stock by the company for the purpose of reconstruction and equipment with electricity.

The promoters of the Southbridge & Fiskdale electric street railway of Southbridge, Mass., have voted to increase the capital stock from $35,000 to $60,000.

The Merrimac Cotton company of Lowell, Mass., contemplates putting in an electric plant to furnish power and lighting for the printing room.

A committee has been appointed by the Shelburne Falls, Mass., Board of Trade to investigate the matter of electric lighting and report as to the estimated cost of a suitable plant. This committee consists of Rufus Covell, Herbert Newell and George H. Wilkins.

A party of New Bedford railroad officials visited Providence, R. I., August 8th to look up a possible trolley connection with Fall River from Providence, and to be continued from Fall River to New Bedford.

The Common Council of the city of Haverhill at a recent meeting voted to indefinitely postpone action on the ordinance to put the telephone wires underground. Samuel L. Powers of Boston, representing the New England Telephone & Telegraph company, addressed the board in favor of the ordinance. He stated that the terms offered the city were those accepted by a majority of the cities of the state. It is the opinion of many of the residents of Haverhill that the low-tension wires should be put underground in order that the handling of high-tension wires would be made easier and safer.

The Haverhill, Georgetown & Danvers street railway incorporators have elected the following named directors: W. W. Potter and H. S. Perkins of Haverhill; Walker M. Brewster of Georgetown; M. B. Bailey of Topsfield, and C. C. E. Wood of Bradford. It was voted to issue $100,000 of stock in shares of $100 each. C. S. G.

## Buffalo and Niagara Falls.

BUFFALO, August 23.—After long discussion the joint committee of aldermen and councilmen has decided to impose a gross tax of 5 per cent. on the receipts of the Niagara Power company for the privilege of using the streets of Buffalo and doing business in this city. The price of the power is to be unrestricted in lots under 20 horse power, but in quantities of over 20 horse power to one consumer the company will not be allowed to charge over $25 per horse power for continuous power 24 hours a day.

The Niagara Falls and Lewiston electric railroad is now in operation. Its scenic attractions are great, as it runs through the famous Niagara gorge.

President George Urban of the Buffalo & Niagara Falls Electric Light & Power company expects that the company's plant will be furnished with power by the Niagara Falls Power company by October 1st. He also says that the new 4,000 light machine that has just been put in is ready for use. It is expected that there will be no further complaint about the light service in Niagara Falls.

At the recent trial trip of the cars of the Lock City Electric Railroad company in Lockport, Mayor Atwater officiated as motorman. The people are greatly pleased over the completion of the new line.

Workmen are now engaged in the building of the Carborundum company at Niagara Falls, preparing the foundations on which to place the machinery that will now be put in place as soon as possible. It is stated that the machinery will all be ready to run in four or five weeks, and that operations will begin in the coke grinding department with steam power if the electric power is not ready. According to announcement, electric power will be passing regularly through the conduit before then. Excavation is now being made for the telluric duct to connect the transformer building of the Carborundum company with the electric conduit of the Niagara Falls Power company. The work is in charge of Engineer Throop.

The Pittsburg Reduction company is patiently waiting for the Niagara Power company to touch the button and send in the coveted electrical energy. In the office window is posted the following notice: "Come around when the wheels go around. Power first; then men." It is reported that the company has 500 applications for the 200 situations it will have. P.

## Washington, D. C.

WASHINGTON, August 24.—Although the general contract for building the Columbia & Maryland railway, from Baltimore to Washington, has been let, the exact type of overhead electric material has not been selected. Double-truck, eight-wheeled cars will be used, each equipped with its own motors.

It seems that the government must borrow poles on which to string its wires. The situation came about in this manner: Superintendent Marean of the Western Union Telegraph company has been requested to move back to the new curb line the poles belonging to the company on G street, between Tenth and Fourteenth streets, preparatory to the work of widening that thoroughfare. He has also been asked to give permission to Col. John M. Wilson to string the United States wires on the Western Union poles. The government wires are on the south side of the street, and, in case permission therefor is granted, will be transferred to the other side. The reason for this request is that the United States government has no funds available for the expense of removing its poles.

President John M. Berger and the other officers of local union No. 26 of the Brotherhood of Electrical Workers have secured the votes of enough unions to bring the coming convention of the brotherhood to Washington. The date is November 11–17, 1895.

An important chapter in the trolley controversy has just been added. Vice-rector P. J. Garrigan of the Catholic University has sent a letter to the District commissioners, which was concurred in by Bishop John J. Keane, protesting against the removal of the poles and wires of the Eckington & Soldiers' Home road. "It seems to us," says the vice-rector, "that the public convenience does not warrant interference with our present system of railway. The building of this road and the opening of the university are contemporary events, and their mutual interests were in a large measure bound up together from the beginning. In October of the present year we hope to open a new building for the benefit of a class of students who are not ecclesiastics, and who consequently will not live in the university buildings, as the students in divinity do. Many of them, no doubt, will prefer to live in the city, but they will not travel three miles in a horse car to get the benefits of a university education. In view of the foregoing reasons and many others, and of the fact that no real inconveniences or injury have resulted to the public from the poles and wires on New York avenue during the six or seven years the road has been in operation, it is respectfully submitted that the present mode of conveyance be not interfered with until the company can obtain from Congress authority to issue bonds with which to change its present system of propulsion." In his own handwriting Bishop Keane asks that the trolley system be allowed to continue until reasonable provision can be made for a change. W.

## St. Louis, Mo.

ST. LOUIS, August 24.—The Bell Telephone company of Missouri has decided to waste no more time waiting for underground facilities, and is now reconstructing its entire system with metallic circuits, all overhead, so as to provide for connection with the long-distance telephone lines. The long-distance telephone line will be extended from Terre Haute to St. Louis as soon as the St. Louis exchange is ready. The reconstruction includes the equipment of two additional central exchanges, making four central exchanges, at a cost of some $100,000. The metallic circuit equipment will probably cost another $100,000, making $200,000 the total cost. It is expected that the entire work will be finished by May, 1896. The Bell company is putting down a short section of underground work—the first in the city—which will provide for the removal of the pole line in front of the new Union station and placing the wires in a conduit laid under the train shed of the station. The length of the conduit is about two blocks, and will accommodate all wires now strung on the Market street trunk line.

The St. Louis Terminal Railroad association is having installed by the Bell Telephone company of Missouri a complete telephone exchange system connecting all points in the terminal yards. At present some 40 stations will be connected, each with a complete metallic circuit direct to the central exchange, which is located in the main telegraph office at Union station. These 40 stations are located at all important offices and points in Union station, the signal towers and yards in St. Louis, and also in East St. Louis, Venice, Madison and Granite City, across the river. An improved express system of exchange working will be used, in which the simple act of removing the telephone from the hook effects an immediate connection with the central exchange operator. A storage battery at the central exchange will supply current to the transmitters at the various stations, the current being carried on the regular circuit. A small motor-generator is used to charge the storage batteries.

The Wm. Barr Dry Goods company is having installed a new electric plant consisting of one 40 and one 75 kilowatt 110 volt General Electric generator directly connected to two Watertown engines running at 275 revolutions per minute. There will be 100 Thomson-Houston '93 arc lamps connected two in series. The balance of the output will be used for incandescent lighting, power and light heating purposes throughout the establishment. The new plant displaces an arc light plant which has been in use several years.

The St. Louis and Meramec River railroad, which has been in embryo for the past two years, has at last begun to assume shape. This line begins at the corner of Sarah street and Manchester road, where it makes a connection with the Market street electric line, and extends westward through Benton, Ellendale, Maplewood, Sutton, Edgebrook, Tuxedo, Old Orchard, Webster Groves and Kirkwood to Meramec Highlands.

Mayor Walbridge has returned from a trip to New York, Philadelphia and Boston, where he examined into the conduit systems. He is well pleased with the Boston conduit system. When the Municipal Assembly convenes Mayor Walbridge will address a message to that body on the subject of conduit systems.

The Citizens' Railroad company is now relaying its tracks with 60 foot steel rails.

The first trolley party ever given in St. Louis was given last week by the Lindell Railway company.

The construction of the Jefferson Barracks electric road has been deferred until October.

The Union Depot Railroad company has about finished the entire equipment of its cars with fenders.

The giant twin engine generator of the Union Depot Railroad company is finished and in successful operation. This generator, which is the largest in St. Louis, is capable of developing 3,000 horse power and has cost some $40,000.

The Chicago, Burlington & Quincy company is equipping its double-track line from St. Louis to West Alton, a distance of some 27 miles, with the Hall automatic electric block system—the first of the kind in this vicinity. The Hall system is one of the most simple and complete systems for blocking double-track traffic and assures almost complete safety against rear-end collisions. R. J. H.

## PERSONAL.

Dr. W. P. Freeman of the Newton Rubber company of Boston, Mass., has been spending a few days in New York on business in connection with this company.

Rodolphus Fuller has been appointed manager and superintendent of the Fontaine Crossing & Electrical company of Detroit, Mich., to succeed R. Humffreys-Roberts.

The many friends of W. J. Hammer of New York will regret to hear of the demise of his father, W. A. Hammer, who died suddenly at Intervale, N. H., on the 12th instant. The deceased was a gentleman prominently known in Philadelphia through his connection with the Grand Army of the Republic and as manager of the Theological Seminary of the Reformed Episcopal Church of Philadelphia. The funeral services were held at Newark, N. J.

Joseph M. Hill, the genial manager of the Chicago office of the Columbia Incandescent Lamp company of St. Louis, has just returned from an extensive trip through Michigan. Mr. Hill reports, of course, extensive competition among all the lamp manufacturers, but he also brings the news that there is a decided inclination among lamp buyers in that section to buy better lamps; that is, to buy a good lamp at a good price rather than a poor lamp to save a little money on first cost. Stations find that in order to hasten what is now considered to be the sure downfall of the Welsbach burner, it is necessary to use a strictly first-class lamp giving full candle power through its entire life. Mr. Hill has been an aggressive worker for the Columbia company, and no little credit is due him for his persistent efforts in keeping his company's lamps continually before the central station men of his territory.

A. L. Tucker of the Western Electric company, Chi-

cago, and C. E. Sargent, the Chicago representative of the Ball & Wood company, were in New Orleans recently looking after their companies' interests in connection with the propositions for the electrical apparatus to be installed in the new St. Charles Hotel, and were successful in securing the contract for two 75 kilowatt and one 35 kilowatt direct-connected multipolar dynamos, and two 150 horse power tandem compound and one 50 horse power simple Ball & Wood engines. They also secured a contract from the Grunewald Hotel for two 30 kilowatt direct-connected multipolar dynamos and two 50 horse power simple engines. These gentlemen not only secured a couple of nice orders while there, but enjoyed catching hard and soft shelled crabs, salt sea bathing and a feast in a vineyard of the famous Southern Scuppernong grape. Mr. Tucker returned to Chicago with a menagerie of chameleons and alligators and a collection of antique china.

## ELECTRIC LIGHTING.

The Star Electric Light company of Dubuque, Ia., is increasing its plant to a capacity of 12,000 16 candle power lamps. Two machines, described by the *Dubuque Times* as "double faze," have been added. The same authority gives this additional information: "Their capacity may be seen when it is told that they make 7,200 alternations per minute."

The Edison Electric Illuminating company of Altoona, Pa., of which E. B. Greene is superintendent, has awarded the following contracts for the new power house and apparatus: Building to W. V. Hughes of Altoona, Pa.; engines to the Ball & Wood company of New York; boilers to Edge Moor Iron company of Wilmington, Del.; dynamos to Pennsylvania General Electric company, Philadelphia; self-supporting stack to the Edge Moor Iron company of Wilmington, Del.

Citizens of the village of Rantoul, Ill., have contracted with the Western Electric company to construct and maintain an electric light plant in that village. The local company will be known as the Rantoul Electric company, and must be incorporated within 40 days or forfeit a deposit of $500. The contract made between the company and the village provides that the village shall use 12 arc lights on the streets at $5 per month per light for a period covering the present fiscal year and two years thereafter.

The City Council of Nevada, Mo., has granted Colonel George W. Dudley of St. Louis the franchise to put in 50 electric lights at $75 per month, with the privilege of putting in an electric street railway. George Myers, of Kansas City, representing the Missouri & Kansas Trust company, offered 2⅛ per cent. of the gross earnings; J. Bailey, of Argentine, Kas., 2½, and Col. Dudley 2⅛ per cent. The council rejected the others as straw bids. Col. Dudley says he will begin on his plants immediately and will push them until completed.

E. G. Flinn of Lake City, Iowa, has obtained an exclusive 20-year franchise for an electric light and power plant in that place. The town agrees to take 15 arc lights of 1,200 candle power each at $900 per annum. An interesting section of the ordinance reads as follows: "Said grantees shall not burn more light from any one dynamo than said dynamo is guaranteed to burn, and they shall in all cases cause each and every light used by any consumer to cast the full and complete power that said light is warranted to produce."

## ELECTRIC RAILWAYS.

An electric railway is to be built from Fort Wayne, Ind., to Lake Everett, a near-by summer resort. The road will begin at a point near Brookside, John H. Bass' suburban residence, and will be run directly to the lake, thence west to Columbia City. Arrangements will be made with the Fort Wayne electric railway for the transferring of passengers from the suburban line to any part of the city.

The report of the Rochester Railway company for the quarter ended June 1, 1895, which has been filed at Albany, shows: Gross earnings from operation, $220,167.02; operating expenses, $127,096.98; net earnings from operation, $93,070.04; income from other sources, $1,536.66; gross income from all sources, $94,606.70. The report for the same quarter of 1894 showed: Gross earnings from operation, $179,969.47; operating expenses, $104,042.60; income from other sources, $1,949.98; gross income from all sources, $77,876.76.

The West End Street Railway company of Rockford, Ill., passed into the hands of a receiver July 31st. The petition was made by John Farson of Chicago, a stockholder and director, who, it is said, represents the bondholders. Attorney L. H. Fuller of Chicago, representing Mr. Farson, went before Judge James Shaw in Mount Carroll in chambers and presented an order making the Title Guarantee & Trust company of Chicago receiver. The company was organized in 1890 with a capital stock of $75,000. Hard times cut the business of the company, and it has been doing a losing business for the last two or three years. L. H. Fuller is in charge at present.

It now seems certain that the new Mystic valley electric railway from Stoneham, Mass., to Arlington will materialize. The committee that has been looking into the financial side of the enterprise will recommend the raising of stock capital to the amount of $65,000. The starting point of the line in Stoneham will be at Farm Hill station, thus securing a junction with the Stoneham & Reading and Stoneham & Wakefield lines. The entire length of the road will be about eight miles. The board of directors to be reported by the committee will consist of Hon. Onslow Gilmore of Stoneham, William Bassett of Arlington, Edward F. Johnson of Woburn, Arthur E. Whitney, George S. Littlefield, Edwin K. Blakie and Abram Coffin of Winchester.

According to a dispatch from Long Branch the Atlantic Coast electric railroad is an accomplished fact. Scores of yellow cars are all ready at Asbury Park waiting for the line to be finished, which, it is promised, will be in 10 days from now. The terms on which the franchise is granted are that the trolley company shall pave Second avenue with vitrified brick and shall give the city one per cent. of the receipts. A bid for another franchise has now been made. This offers for Second or Third avenue and any streets turning at right angles to the same, to the city limits, west, $5,000 per annum, the company to gravel the streets so used. This proposition says: "Our road will be of more advantage to your city than any other talked of or projected line. From your western boundary it will run in a direct line to Asbury Park, passing through West Long Branch, Oceanville, Interlaken, connecting with the Belmar road now in operation, thence on to Sea Girt and Point Pleasant. To the north it will connect with Red Bank, passing through Eatontown, Shrewsbury, Red Bank, and so on to Atlantic Highlands, with a branch from Eatontown to Freehold and other towns in that vicinity."

## MISCELLANEOUS.

A new publication, devoted to the general advancement of British commercial interests, has made its appearance in Manchester, England. It is a monthly and bears the name of *The Trade Journals' Review*. Electricity is given a due share of attention. The *Review* gives evidence of good editing and has a clean, bright, progressive appearance. One glaring inaccuracy in the July issue—the statement that "It is not generally known that it is possible to ship goods direct from Manchester to Chicago by water, if vessels will proceed from the Atlantic into the lakes *via* the Erie canal"—is noticeable, but on the whole the new journal makes a good impression.

Many improvements and additions have been made at the dynamo laboratory of the University of Illinois at Champaign, Ill. It is located in the basement of University Hall and includes a direct current dynamo room, an alternating current dynamo room, two general testing rooms, a battery room, a photometry room, a store room and a work room. The laboratory is supplied with power from a 50 horse power steam engine. The equipment in direct current machinery includes a Brush 10 arc light plant, a Thomson-Houston three arc light plant, two Edison and a Thomson-Houston incandescent dynamo and a Jenney 500 volt power plant. The alternating current machinery comprises a Thomson-Houston 300 light plant, two small single-phase Westinghouse machines and a number of transformers. The measuring instruments are of late design and from the best makers. There are very complete sets of Weston and Whitney ammeters and of Weston voltmeters and voltmeters for direct and alternating currents, electrostatic voltmeters, condensers, electro-dynamometers, Thomson balances, portable testing sets and galvanometers of all kinds. The laboratory is also supplied with much accessory apparatus, such as cradle dynamometers, contact makers, non-inductive resistances, arc and incandescent lamps and an electric light photometer. A number of lathes and a large variety of tools constitute the equipment of the workroom.

## TRADE NEWS.

The line of gasoline engines manufactured by the Wolverine Motor Works of 12 Huron street, Grand Rapids, Mich., is meeting general approval. These engines are said to be the simplest in design and construction and have the best exploder known.

The Central Electric company of 173 Adams street, Chicago, is proud of the record of the Samson battery for long life, great strength and recuperative power. The makers warrant this battery "to stand more hard usage and continue its service longer than any other open-circuit battery made."

Prof. George D. Shepardson of Minneapolis is drawing plans for a municipal lighting plant for Mankato, Minn., to be operated in connection with the present waterworks plant. Provision will be made for about 50 arcs and 150 incandescents, so arranged that an increase of the number of each may be made later.

The Eastern Electric company of Tonawanda, N. Y., manufacturer of non-infringing telephone switchboards, has just closed a contract with a Pennsylvania telephone company for a 400 wire switchboard to be furnished by October 1st. This purchaser made a thorough examination of all the types of boards, and selected that of the Eastern Electric company as the best.

The new edition of the Brown & Sharpe catalogue is out. It has been thoroughly revised and contains 366 pages—60 more than the preceding one. The new matter and the changes in the old make it especially desirable that this should replace former editions. A large number of new tables have been added, making it especially valuable to the workman as a book of reference. These valuable catalogues are mailed to any address without charge, upon application, or are furnished by hardware dealers.

The fitness of the Beacon incandescent lamp for outdoor decoration has just been recognized by two substantial orders. The Boston Electric Light company ordered 9,000 lamps from the Beacon Lamp company for Knights Templar decorations, while 1,000 more were ordered for Keith's Theater for the same purpose. The Beacon company has also been awarded the government contract for 10,600 lamps for the Navy Yard. The Beacon lamp is evidently appreciated at home.

The Union Heater Supply company of Detroit makes a specialty of fire pots and gasoline forges and torches for the use of wiremen and electricians. The lineman's fire pot is made of the best material and finest mechanical construction. It has a double jet burner, which is mounted on a double swivel, thereby giving the operator the advantage of using the flames in any position required. The upper flame on the burner is called the "needle flame," and is about the size of an ordinary lead-pencil. The lower flame is about 1¼ inches wide. They can be used in conjunction with each other, or the lower flame can be used separately. The company makes gasoline heating appliances of all descriptions and will send catalogues and special estimates on application.

Frequenters of electricity building during the World's Fair were familiar with courteous and genial Geo. D. Burton of Boston, whose electrical process for the heating and forging of metals excited so much interest. Mr. Burton recently passed through Chicago on his way east from California, where he had been engaged in extensive and satisfactory experiments in smelting refractory ores. Mr. Burton received extensive mention in the San Francisco papers, and he states that financially his trip was a great success, as he has already disposed of certain territorial rights for his electrical smelting process. The sample case which he brought back with him from California showed some remarkable results from the application of his process to the reduction of refractory ores. Mr. Burton has for a long time been defending his patents against foreign encroachment, but to-day he feels that he is victorious and looks for a rapid introduction of the Burton process during the next few years. Mr. Burton has unquestionably been an indefatigable worker in this field and deserves success.

Manager A. M. Searles of the Diamond Electric company of Peoria is now nicely equipped for business in his new suite of offices at 1315 Old Colony building, Chicago. Mr. Searles is not only manager for the sales department of the Diamond Electric company, controlling this concern's entire output, but he is likewise general agent for the central states for the National Electric company of Eau Claire, Wis. Mr. Searles, besides pushing the well-known National machinery, is meeting with great success in making sales of the Scheeffer recording wattmeters. As is well known, this device is an exceedingly simple piece of machinery, registering correctly the actual power consumed. It has no commutator, no brushes and no wire on its armature. It is claimed to be absolutely accurate on one lamp as well as a full load. A glance at the illustrations in the Diamond company's neat little catalogue shows in a moment the extreme simplicity of these meters. Mr. Searles expects shortly to take hold of another specialty which is of a very meritorious character and one that will without doubt create something of a sensation in the electrical field.

## BUSINESS.

Among the yachts on which the chloride accumulator has been installed for lighting purposes this season are the Linta, Sultana, Alcedo, Duquesne, Huntress, Washita, Vidette and Thespia.

The Newell para-pneumatic pulley, patented by D. E. Newell, foot of West Nineteenth street, New York, is said to prevent slippage of belts and to give the nearest approximation to the maximum theoretical power of any machine to which it is applied.

The National Lead company, whose Chicago branch is at Fifteenth and State streets, manufactures several products that are needed by electrical manufacturers. Its booklets, "Red Lead and How to Use It" and "Concerning Babbitt or Anti-Friction Metals," can be obtained upon application.

R. Humffreys-Roberts, representing the Metropolitan Fire Proofing company of Trenton, N. J., with offices at 6 Merrill block, Detroit, Mich., visited Chicago last week. Mr. Roberts is an old and experienced electric light man and has recently taken up the Detroit business of the Metropolitan Fire Proofing company.

The Electric Appliance company has secured some very handsome orders for Upton arc lamps, for which it is general western agent. The alternating lamp with the patent "anti-hum" cover is proving very popular, as it does away almost entirely with the noise of the lamp, which has always been such an objectionable feature in alternating lamps.

The Abendroth & Root Manufacturing company has of late filled a number of notable orders for improved Root water-tube boilers, principally in New York city and vicinity. It may be mentioned in this connection that Arthur Loretz, Jr., formerly New York manager for the National Water Tube Boiler company, is now representing the Root boiler at 28 Cliff street, New York city.

Mandel Bros. of Chicago, after a careful test of all the different makes of incandescent arc lamps, placed an order with J. H. Cooke, 753 Monadnock block, representing the Manhattan General Construction company, for 70 Manhattan arc lamps. The Manhattan is said to be the only arc lamp that will run 100 hours without the trimming of carbons. Burning 10 hours a day, it consumes three pairs of carbons per month.

The new mills of the Grand Rapids Pulp & Paper company, at Bearn, on the Wisconsin river, are being rapidly pushed forward. The company is constructing a dam, excavating a large mill pit from solid rock, and erecting large, substantial brick buildings. It has contracted with the James Leffel & Co. of Springfield, O., for 15 large Samson turbine water wheels, which will be in position in November. All the work is being done upon the most approved plan and is of the most substantial character.

H. J. Medbery, the president of the Fiberite company, manufacturer of the Medbery overhead material and other specialties, has been visiting Chicago and is greatly encouraged, not only with the present business, but with the encouraging outlook for the fall trade. The large orders received for this high-grade material have compelled the company to run its factory day and night for several months past. The factory being one of the largest in the country, this means a very large output and testifies to the appreciation in which the Medbery material is held.

The Keystone Telephone company of Pittsburg, which was organized last spring, notes a very steady and encouraging growth in its business. It has recently secured some large contracts, and now has on its books orders for over 3,500 telephones. The really remarkable growth of the

business is the best recommendation that can be given of the excellence and character of the telephone presented to the public by this company. Every instrument that is sent out is inspected by competent telephone engineers, and purchasers are assured a telephone that is certain to give entire satisfaction.

H. E. Collins & Co. of Pittsburg, manufacturers of the Cahall boiler, assert that the best testimonial is a repeated order, and give this list: Shoenberger Steel company, Pittsburg, Pa., four orders, 1892 to 1895, 1075 horse power; Republic Iron Works, Pittsburg, Pa., three orders, 1892 to 1895, 375 horse power; Ætna Standard Iron company, Wheeling, W. Va., two orders, 1893 to 1895, 200 horse power; Zug & Co., Pittsburg, Pa., two orders, 1894 to 1895, 450 horse power; Philadelphia Gas company, Pittsburg, Pa.; three orders, 1894 to 1895, 2,000 horse power; Salem Iron company, Leetonia, O., two orders, 1894 to 1895, 500 horse power; Inland Steel company, Chicago, Ill., two orders, 1894 to 1895, 400 horse power; Brown, Bonnell & Co., Youngstown, O., two orders, 1895, 364 horse power; Cornwall Iron company, Cornwall, Pa., two orders, 1895, 600 horse power; Apollo Iron & Steel company, Apollo, Pa., three orders, 1895, 10,250 horse power.

The Westinghouse Machine company reports business active and the outlook flattering. Orders for compound engines during the last month include one 250 horse power to Whittenton Manufacturing company, Taunton, Mass.; one 100 horse power and one 125 horse power to American Hydraulic Dredging company, East Douglas, Mass.; one 80 horse power and one 100 horse power to Sioux Consolidated Mining company, Mammoth, Utah; one 200 horse power to Wendell & Smith, Overbrook, Pa.; two 80 horse power to Upper Peninsula Hospital for the Insane, Newberry, Mich.; four 250 horse power to United States Capitol building, Washington, D. C.; one 250 horse power to Connellsville Electric Light company, Connellsville, Pa.; one 250 horse power to Belvidere, Ill., Electric company; three 160 horse power to Carnegie Library building, Pittsburg, Pa.; one 125 horse power to Hackensack, N. J., Gas & Electric company; one 300 horse power to Wilkinsburg, Pa., Electric company; one 250 horse power to Sing Sing, N. Y., Electric company; one 200 horse power to Gloversville, N. Y., Electric company. In addition to those named the increased number of orders for "Standard" and "Junior" automatic engines indicates a general revival in all branches of manufacturing.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

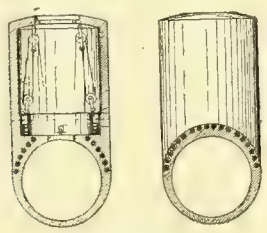
*Issued August 20, 1895.*

544,647. Automatic Electrical Railway Signal. Chas. R. Alsop, Middletown, Conn. Application filed October 22, 1894.

An electric motor is used, together with a swinging signal target attached to the armature shaft of the motor, suitably arranged track circuit closers, and a switch device included in the circuit of the motor windings and the circuit closers to provide for automatically closing the circuit through the motor when the target reaches an elevated position.

544,654. Plant for Generating Electricity. George R. Bowen, San Antonio, Tex. Application filed February 21, 1895.

An imperforate cylinder, rotatable around an upright axis, and provided with vertical tangentially disposed blades, and a series of upright tangentially disposed guides or vanes fixed in the ground or to a base, and arranged around the blades or paddles, a roof overlying the guides or vanes, and blades or paddles are provided with electrical apparatus, and means for imparting motion from the cylinder to said electrical apparatus.



NO. 544,747.

544,668. Apparatus for Electro-plating. Frank Engelhard and Frederick H. Engelhard, Springfield, Mass. Application filed March 23, 1892.

The invention comprises a tank, hanger supports thereon, hangers horizontally adjustable on the supports, shafts vertically adjustable on the hangers, electrodes carried by the shafts, and means for simultaneously rotating the electrode supports.

544,673. Secondary Battery. Frank King, London, Eng. Application filed April 5, 1895.

Protruding portions of the conducting support are burned or soldered to a bar, each electrode comprising active material, a grid for the material, having pins thereon, and a porous diaphragm, sheet covering or envelope through which the pins project. Insulating strips are wedged between the plates or electrodes, and held in position by engagement with the pins projecting through the diaphragm, sheet or covering, so as to fix the distance apart of the plates or electrodes, and maintain them in position, and the active material in position thereon.

544,677. Trolley Arm and Attachment Therefor. George Maag, Newark, N. J. Application filed December 12, 1894.

This is a trolley arm, composed of tubular sections, a flexible joint connecting the sections, a flexible rod within the sections, and means for securing the rod in position in the sections.

544,685. Electric Locomotive. Edwin H. Porter, Radford, Va. Application filed June 22, 1894.

The driving axles of the locomotive carry cranks of a given radius, connected by rods, and a pair of armatures of an electric motor have cranks of one-half the length of the former, and there are connecting rods joining the armature cranks to the main connecting rods, and having the same radius as the cranks of the driving wheels of the locomotive, the centers of the driving axles and of the armature axles being in a straight line parallel to the main connecting rods.

544,711. Telephone Switch and System. Ernest C. Wilcox, Meriden, Conn. Application filed May 13, 1895.

There is a receiver support, consisting of a fixed part and a part movable laterally with respect thereto, switch mechanism having a contact connected to the movable part, and a device connected to the movable part for holding it in its normal position until moved outwardly by the withdrawal of the receiver and for holding it in the outward position until manually returned to the normal position.

544,745. Electrically Controlled Weighing Apparatus. Lorenzo H. Nutting, Davenport, Ia. Application filed November 13, 1894.

A balanced hopper is adapted to receive the material to be weighed. It has angularly disposed outlet doors, a pair of pivoted levers connected respectively at their free ends to the doors, and connected at their pivot point with a lever fulcrumed in the hopper, and having its outer end engaging a rod, a chute located above the hopper, having a pivoted outlet gate, and a crank for opening and closing the gate, and electrically controlled mechanism for elevating the rod to open the doors of the hopper, and for turning the crank to alternately close and open the gate of the feed chute.

544,747. Manhole for Electric Cable or Other Subways. Ernest L. Ransome, Chicago, Ill. Application filed January 11, 1895.

The cut shows a shell serving as a conduit for water or sewerage, and having a series of smaller conduits in the body, a manhole chamber serving as a means of entering the main conduit, electric wires passing through the auxiliary conduits and around the wall of the manhole chamber, and a shield for protecting all wires within the chamber.

544,749. Electric Motor. Benjamin P. Remy, Peru, Ind. Application filed November 24, 1894.

The claim: In an alternating current electric motor, the combination of radial electro-magnets adapted to rotate together, a commutator suitably connected to said electro-magnets, and a stationary iron part of an elliptical oval or similar shape, said stationary iron part generating no magnetism but obtaining its magnetism wholly by induction from the revolving part.

544,768. Electric Elevator. Nils O. Lindstrom, Brooklyn, N. Y. Application filed May 16, 1895.

A feature of the invention is a controller, comprising two compound cores, having their members magnetically insulated from each other, solenoid coils co-operating with one member, and auxiliary solenoids co-operating with the other member.

544,778. Insulator for Electric or Other Wires. Clinton Sproat and Edward N. Tarr, Taunton, Mass. Application filed January 2, 1895.

The device consists essentially of the externally screw-threaded pin, the base internally screw-threaded and provided on its upper side with the grooves, and the head or cup internally screw-threaded and provided with concentric corrugations on its under side.

544,781. Electric Switch. Thomas H. Brady, New Britain, Conn. Application filed May 3, 1895.

The contact jaws are of a rigid character, one in each pair being pivoted to its frame, and having also a separate spring frame and spring adjacent to the frame of the jaws, with its spring bearing upon the pivoted jaw for forcing it to its work.

544,794. Trolley Arm and Wire Finder. Frederick W. Riess, Philadelphia, Pa. Application filed June 10, 1895.

Combined in this device are a two-part arm, a guide-way formed in the upper part of the arm, a trolley wheel journaled to an arbor slidingly mounted in the guide-way, a lever pivoted to each end of the arbor and hinged by a slotted connection to opposite sides of the guide-way, and a resilient wire guard or wire finder pivoted to the free end of the lever.

544,844. Carbon Brush Holder for Dynamo-electric Machines. Alexander J. Churchward, Brooklyn, N. Y. Application filed May 14, 1894.

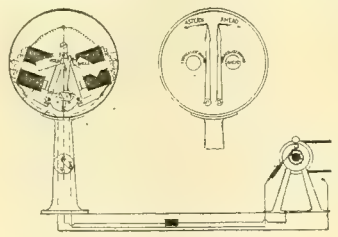
This holder comprises a frame adapted to receive a plurality of brushes therein, plates attached to each of the brushes, conducting rods secured to the plates, springs surrounding the conductors, means for adjusting the tension of each of the springs independently of the others, and a conductor connecting with the conductor rod.

544,847. Apparatus for Insulating Electrical Conductors. Louis W. Downes, Providence, R. I. Application filed April 6, 1895.

Means are provided for wrapping or coiling the fiber upon the conductors Spring-actuated levers compact or flatten out the fiber, pressing upon the latter in diametically opposite directions and means for preventing the movement of the levers past the axis of the conductor are also provided.

544,862. Electric Railway. James F. McLaughlin, Philadelphia, Pa. Application filed April 17, 1895.

A series of contact blocks is spaced along the road, and a collector comprising a continuous and rigid metallic frame is carried on the car, and a series of independently spring-controlled yielding brushes are mounted in the frame in electrical connection therewith.



NO. 544,876.

544,863. Electric Railway. James F. McLaughlin, Philadelphia, Pa. Application filed May 3, 1895.

A main or supply conductor and feeding conductors or contacts, switches for coupling the supply and feeding conductors, each switch being provided with a latch for locking it in the open position, and traveling electro-magnets unlocking and operating the switch.

544,876. Ships' Telegraphic Apparatus. Johannes K. Adelsberg, Liverpool, Eng. Application filed March 16, 1895.

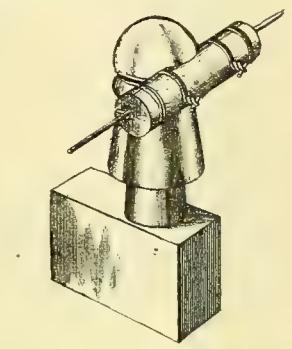
The improvement described in connection with ships' direction indicators consists of the combination of electro-magnets pivotally mounted and vibrating armatures, toothed racks on the vibrating armatures, pinions meshing with the racks, shafts on which the pinions are mounted, pointers mounted on the shaft, a dial plate having on it the words "Ahead" and "Astern," and over which the pointers move.

544,890. Magneto-electrical Telephone. Max Frank, Munich, Germany. Application filed June 30, 1894.

One claim is given: In combination in a telephone and for the purposes described, the magnetic core, magnetic shell or tube, the magnetic plate secured to or formed with the said magnetic core, and making contact with the interior surface of the said tube, a screw or other adjustment for the said plate, and a set-screw for fixing it in position.

544,901. Telephone Exchange Apparatus. Joseph J. O'Connell, Chicago, Ill. Application filed April 29, 1893.

In a telephone exchange system, comprising a multiple switchboard and suitable adjunctive apparatus, the combination is claimed with the operator's telephone circuit and a key, whereby the circuit is thrown into and out of circuit of subscriber's line of a signal, and means for controlling the signal connected with the key, whereby when the key is shifted to throw the operator's telephone into the subscriber's circuit the signal will be brought into action to indicate that the operator is busy, and when the operator's telephone is cut out of the subscriber's circuit the signal will indicate that the operator is idle.



NO. 544,959.

544,937. Electric Train Signal. Francis C. E. von Sternberg, Brooklyn, N. Y. Application filed April 13, 1895.

This system has a starting circuit, including a generator and a signal, and comprises two partial circuits located on each car of the train, each partial circuit on each car being provided with a circuit-closing device arranged to hold it normally open, and being arranged to form when closed a shunt or short circuit to the other partial circuit on the same car.

544,959. Insulator. Reuben G. Collins and Frank W. Foley, Dollar Bay, Mich. Application filed February 25, 1895.

In the insulator illustrated there is the combination with a support, of a sheath provided with a tortuous groove or slot for the reception of a wire.

545,005. Multiple Electric Circuit and Mechanism for Maintaining Same. Timothy K. Ames and Elbert A. Parker, Peterborough, N. H. Application filed October 19, 1894.

The combination consists of a switch, comprising a ring, having a number of sets of blocks and a contact brush or brushes, means for rotating one part of the switch in respect to the other, conductors providing an electrical connection between the corresponding blocks of each set on the ring, a series of distributing terminals one for each block of a set on the switch, each of the terminals being connected to one wire of the working circuit, electrical connections between each distributing terminal and its corresponding block of each set on the switch ring, and a direct line wire serving to return the current from the working circuits to the generator.

545,009. Trolley. George W. Biddell, Chattanooga, Tenn. Application filed February 2, 1895.

A trolley comprising a rod, having a sleeve or head secured upon the end thereof, a shoulder projecting upwardly from the head, and a block pivoted upon the head having the trolley journaled thereon, the block being adapted to partially rotate or yield laterally, and being limited in such movement by engagement with the shoulder of the rod.

545,020. Electrically Controlled Winding Mechanism for Time Locks. William H. Hollar, Philadelphia, Pa., George L. Weaver, Boston, Mass., and Anthony Kennedy, Charlestown, W. Va. Application filed April 1, 1895.

The invention includes the combination with a time lock for a vault or safe, of a rewinding motor operatively related to the clock spring of the time lock movement, a detent normally restraining the action of the rewinding motor, an electrically actuated disengaging device for the detent, an electric circuit controlling the disengaging device independently of the clock mechanism, and means situated exterior to the vault, whereby the circuit may be controlled.

545,021. Electric Winder for Time Locks. William H. Hollar, Philadelphia, Pa., George L. Weaver, Boston, Mass., and Anthony Kennedy, Charlestown, W. Va. Application filed April 17, 1895.

In this arrangement there is included a time lock for a vault or safe, a re-winding electric motor situated within the vault and operatively related to the clock spring of the time lock, an electric circuit comprehending the motor and provided with a source of electricity, and means independent of the clock movement and located exterior to the vault, whereby the circuit may be controlled.

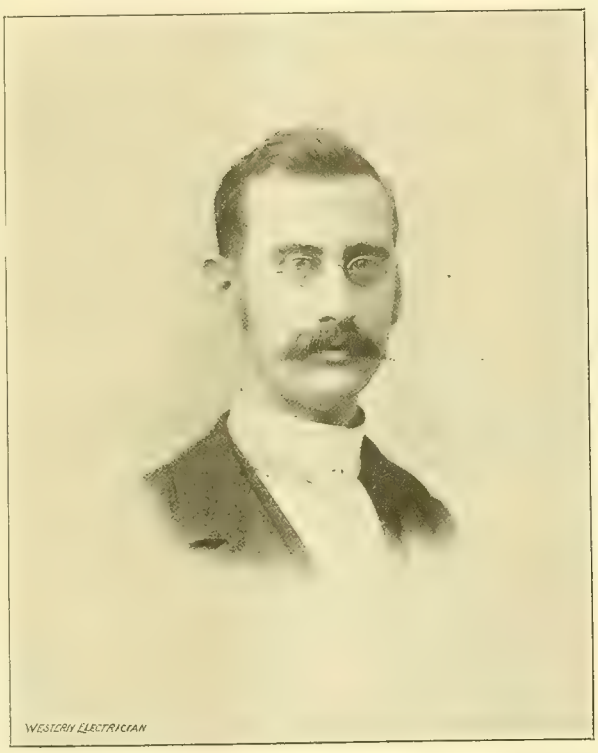
# Western Electrician.

EVERY SATURDAY.

Vol. XVII. CHICAGO, SEPTEMBER 7, 1895. No. 10


## Prof. W. M. Stine and His Work at Armour Institute.

The importance of such a school as the Armour Institute, or the Armour Institute of Technology, to be strictly up to date, in a city like Chicago can hardly be overestimated. Devoted alike to mind culture and manual training, with an able and enthusiastic corps of instructors, magnificently equipped and backed by ample means, the Institute has entered upon a great work. As the new name implies, the school offers to the youth of Chicago and the West all the advantages of a technological institute; and it cannot be doubted that through the impress of its training on the brains and hands of the earnest young men and women who gather under its roof a distinct advance will be made in solving the sociological and engineering problems that are constantly arising in the rapid development of Chicago and the country tributary to it. The Institute seems to be admirably supplying the need of a center of technical education in Chicago. It has enrolled over 1,000 students, and its facilities for research and experiment have attracted the meetings of such bodies as the Western Society of Engineers and the western branch of the American Institute of Electrical Engineers. Its laboratory equipment is most complete, the cost of the machinery, instruments and appliances in the electrical department alone being over $64,000. But it is of much more consequence that the instructors be men competent to use to the greatest advantage, in directing the work of students, the material resources so lavishly placed at their disposal. The Institute is fortunate in this also. Dr. Gunsaulus, the president of the faculty, is untiring in carrying out the benevolent designs of the founder, P. D. Armour. He has surrounded himself with men who have the ability and energy necessary to achieve success on original lines in the chosen field of the Institute. Naturally the readers of this journal will be most interested in the director of the department of electricity. This is Prof. W. M. Stine, whose portrait accompanies this article and who is the subject of the following sketch.




PROF. W. M. STINE.

Wilber M. Stine was born at Tyrone, Pa., November 3, 1863. He attended several academies and seminaries in his native state. After completing preparation for college, he entered Dickinson College, Carlisle, Pa., graduating in the class of 1886. He early showed an inventive turn of mind and gave especial attention to railway practice and motive power. While still a boy young Stine built several successful steam engines, making his own tools, patterns, castings, etc. These were worked out solely by the help of a few old works on natural science. Owing to natural aptitude and the attention he had given railway practice, a position was tendered to Mr. Stine in the motive power department of a large eastern railway system, with flattering prospects of advancement. But being appointed assistant in chemistry at Dickinson at this time, he determined to give up railway engineering to devote himself to research work and the teaching of physics and chemistry. After graduation Mr. Stine was appointed assistant professor of physics and chemistry at the Ohio University, Athens, O., which enjoys the pre-eminence of being the first state university established in this country. The following year he was appointed to the duties of full professor to succeed Dr. C. Leo Mees, now president of Rose Polytechnic Institute, Terre Haute, Ind. In 1889, on leave of absence, he studied electro-technics in Europe, chiefly in Germany. Upon his return Prof. Stine established a department of electrical engineering at the Ohio University, and installed its lighting system. In 1888 and 1889 he made the first tests of the leading non-magnetic watches, and published the results in hte technical journals.

In February, 1893, Prof. Stine accepted a call to establish a department of electrical engineering at Armour Institute, Chicago, now incorporated as the Armour Institute of Technology, by which name it will be known in the future. His official position is director of the electrical engineering department. During the World's Fair he served as one of the judges on the jury of awards for the electrical department. He has devoted much study and research to storage batteries, giving especial attention to alkaline and carbon types, and also acted as editor of *Electrical Engineering* until its recent reorganization, when he resigned.

Prof. Stine devotes much attention to research along the lines of pure and applied science and has been a frequent contributor to the leading scientific and technical journals. He is at present engaged on a number of investigations of importance in electric lighting. He has been retained, also, for expert work, consultation and the installation of steam and electric plants. He is a member of the American Association for the Advancement of Science, the Franklin Institute and the American Institute of Electrical Engineers, and has received the degrees of M. S., D. Sc. and Ph. D., all on examination, the two first mentioned from his alma mater and the last from Ohio University.

The Armour Institute of Technology being a new institution and wholly devoid of old prejudices and precedents, Prof. Stine determined to make some educational changes and innovations. For a number of years he had been collecting opinions from the leading electrical manufacturing companies and engineers on the value of the usual technical education. These criticisms and suggestions were given due weight in formulating the courses. Realizing that the older institutions which had developed thorough mechanical courses had merely attached electrical engineering as a supplementary course, and that due prominence was not given this training. and that in still others the electrical instruction was but an extension of the work in physics, it was deemed best to modify existing methods considerably, and establish a full department for electrical engineering, distinct from both the physical and mechanical departments.

The aim is to make the course scientifically practical. So far the success has been very gratifying. By omitting unnecessary shop practice and placing the requirements for admission higher than usual, time has been obtained for thorough electrical laboratory practice throughout the entire four years of the course. This enables a more scientific examination of many advanced methods of measurement and investigation. This also implies more thorough and advanced work in mathematics. It is hoped that the physics and mathematics may be so thoroughly co-ordinated as to give graduate engineers increased power in their electrical work.

An unique system of illustrating lectures has been developed by Prof. Stine. By the use of a powerful electrical projector lantern-slide illustrations are used exclusively in the lectures without in the least darkening the lecture room. The cabinet of slides embraces all the more important illustrations in the text books, many from electrical periodicals, and copies of original drawings. The slides are all made by the department.

Another feature of the department is its apparatus shop. This is thoroughly equipped with the best tools. It is in charge of a mechanician who was formerly connected with the normal meter department of the Phys. Riechsanstalt, Berlin. In addition there are four assistants and a draftsman. A number of new and valuable pieces of apparatus have been constructed here, designed by the director, the latest being a variable potential rheostat.

## John L. Martin.

It is with much reluctance that the WESTERN ELECTRICIAN yields to a sense of duty and gives public warning that the members of the electrical fraternity must be on their guard in financial transactions with John L. Martin. For several years Mr. Martin held the responsible position of head of the central station lighting department in the Chicago office of the Thomson-Houston and General Electric companies. Later he was a member of the firm of Chicago selling agents for the National Electric company. Mr. Martin is widely known to the electrical trade and was well liked and highly respected. But for the last year or so his friends have noted, with great sorrow, that he has been going to pieces, morally. He has been going about the country passing checks on Chicago banks which have proved to be worthless. This operation has been repeated so often that no doubt can remain of the intent to defraud. Mr. Martin's friends in better days have been the sufferers, and no action has been taken. About two weeks ago Mr. Martin presented a check to William F. Brewster of the New York office of the General Electric company and requested him to cash it, as it was after banking hours. The check was for $100 and was drawn on the Illinois Trust & Savings Bank of Chicago, in favor of John L. Martin. It purported to be signed by B. E. Sunny. Mr. Brewster accommodated Mr. Martin, but when the check was sent to Chicago for collection it was discovered that the signature was forged. Mr. Brewster is out the $100 and the cost of protesting the check. Other instances of like character could be cited. Electrical men must take warning.

## Trolley Cars for Funerals.

Managers of electric street railways are preparing for the casket, pall-bearers, ministers, mourners and friends. Funerals by electric car to the far-away cemeteries, they believe, is the next step in surface transportation. It is intended to furnish a cheap means of reaching the cemeteries with as little discomfort as possible. The result is that somber-colored cars with mourning drapings will be made and put in Chicago streets on order within a few months. To introduce the service two cars will be constructed especially for the purpose to which they are to be put. In interior fitting and finishing they will differ materially from the ordinary car. They will be painted black on the outside and bear other indications of their character. Funeral parties may charter the train and start from any point on the line of the road. Arrangements will be made to transfer the train to the Cicero & Proviso tracks, which run direct to Forest Home, Waldheim and Concordia cemeteries.

An electric railroad from Providence to New Bedford and Fall River, Mass., will probably be built soon.

## Down-draught Furnace for Steam Boilers.[1]

By William H. Bryan.

Probably no mechanical device has done as much toward the practical solution of the smoke problem in St. Louis as the down-draught furnace. Until this apparatus was developed there was a certain character of steam plants—or rather of steam service—to which it seemed that none of the existing forms of smoke-abating furnaces could be satisfactorily applied. In these plants—fortunately few in number—the demand for steam was such as to make it necessary at times to crowd the boilers far beyond their rated capacity. Or else the work was subject to frequent and extreme fluctuations, often greatly exceeding the rated capacity of the boilers. It may be said, of course, that this is abuse rather than proper use of a boiler plant, but, nevertheless, these conditions exist, and it is sometimes impossible either to modify the conditions or increase the boiler capacity.

The fact that there seemed no practicable or reasonable remedy for these cases retarded the growth of the smoke abatement movement in St. Louis for many years. It was thought unwise to pass and attempt to enforce smoke-abatement ordinances when it seemed impossible for some of the plants to stop the smoke under reasonable conditions. The demonstration of the fact that the down-draught furnace made a good smoke record possible, even with overworked boilers doing variable work, and with a marked economy in fuel, may be said to have marked an epoch in smoke abatement. Our experience in St. Louis leads us to believe that smoke from boiler furnaces can now be abated by practical means without hardship, no matter what the type of boiler, the character of the work required of the plant, or the kind of fuel used.

I speak thus highly of the down-draught form of furnace with no intention of denying the merits—for they are many—of other smoke-abating devices. Many of these do excellent work under most of the conditions occurring in practice. In my opinion, however, no single furnace now on the market can be adapted to all the conditions met with in everyday boiler service. Each type has a place, a field of usefulness, within which limits its success is sure. Unfortunately, however, the average furnace man seems unable to realize this truth, but offers his device as a remedy for all sorts of cases and conditions. It is not surprising, therefore, that he sometimes meets with failure.

Where the work required of a boiler plant does not greatly exceed its rated capacity, and is reasonably uniform, there are many good smoke-abating furnaces which may be used, some of which will make an appreciable saving in fuel. If our boiler plants were properly designed and managed, and if we did not have sometimes to overwork them and to subject them to widely varying loads, the smoke-abatement problem would be greatly simplified. The fact, however, that even such discouraging conditions as these can now be intelligently remedied, has led to the preparation of this paper.

Fortunately for the steam-using public, several different forms of down-draught furnaces are offered for sale by various builders, and under different patents. I have had no opportunity of looking up the number and value of these patents, but it would seem that they refer to important details of construction and arrangement rather than to general or essential principles. It is not necessary to consider here whether or not the manufacturers are justified in charging royalties. Their experience in the design and adaptation of the furnace to varying conditions—and the further fact that, as a rule, they will guarantee results—would certainly appear to entitle them to a fair margin of profit at least.

Although the principles are old, I have been unable to find any record of this type of furnace coming into regular use previous to 1888. It seems that the cost of the apparatus, the necessity for water grates and their frequent burning out, due to defective construction and bad feed water, prevented a general adoption.

The form of down-draught furnace which has come into most general use, and which may justly be said to have contributed more than any other to the present state of the art, is that invented by M. C. Hawley of St. Louis, and which bears his name. Mr. Hawley's experiments began as far back as 1873, and met with varying degrees of success. He was able to show an economy of fuel, and, with proper handling, an almost total abatement of the smoke, even with the low-grade soft coals common in the Mississippi valley. In 1882 Mr. Hawley interested Capt. C. W. Rogers, then general manager of the St. Louis and San Francisco railway, who, after consultation with his master mechanic, decided to build an experimental furnace in the fire-box of a switch engine. The result was so satisfactory that the furnace was soon applied to another locomotive boiler in stationary service. It was then applied to a locomotive in regular service. It was necessary to greatly cut down the grate area, but in spite of this the engine did good service, being practically smokeless and throwing no sparks, even with a straight stack and no netting, until destroyed by a roundhouse fire. The furnace was also applied to a number of the boilers of the St. Louis & San Francisco Railway company, in stationary practice, in the shops and other buildings, where they are still running satisfactorily.

In 1888 a contract was made to place the Hawley furnace under an ordinary stationary boiler in the new factory of the Hamilton & Brown Shoe company, St. Louis, under a very stringent guarantee. The boiler was 60 inches diameter, 20 feet long, with 18 six-inch flues. A similar boiler was set with the ordinary furnace, in the same room. The results in smoke abatement, fuel economy, and capacity were so satisfactory as to lead to the application of the Hawley furnace to the other boiler very shortly afterward. This case marked the beginning of the introduction of this type of furnace into general stationary practice.

A brief description of the characteristic features of the Hawley setting will be of interest. In the earliest forms it consisted of a single row of water grates, these being necessary on account of the high temperatures developed. These water grates were made of two-inch pipe, placed level, and connected with the circulation system of the boiler by water boxes, or headers, and connecting pipes. The supply pipe leading to the front headers was usually taken from near the bottom of the front end of the shell, and the discharge was delivered near the water line. The rear end of the fireplace above the grates was closed off tightly, by means of a hanging water leg riveted to the shell of the boiler, in which suitable openings had been cut. In order to insure circulation in the tubes and prevent their burning off, it was found necessary to have the rear end of each tube project far enough into the water leg to permit attaching an elbow, into which was screwed a riser, reaching up into the main body of the water in the boiler. Further experiments showed that it was usually desirable to put in two rows of water grates, and to stagger them. Even then, however, a considerable amount of unburned fuel fell through the grates, and was hauled out with the ashes, unconsumed. This caused a loss of efficiency when the boilers were crowded, and led to the adoption of the lower grate, which is of the ordinary pattern. This form of the furnace is shown in Fig. 1.

It was at the Hamilton & Brown Shoe Works referred to, that the necessity for the lower grate became evident, and where it was first applied by Mr. Hawley. It is now an accepted feature of all forms of the Hawley furnace, and to it, in my opinion, are largely due the excellent results secured in capacity, efficiency and smokelessness.

In the earlier forms of the furnace the water grates were level. It was soon found that, by placing them on an incline rising to the rear, the circulation was much improved, and the probability of burning off tubes greatly reduced. This plan was then regularly adopted, and the pitch gradually increased until the standard is now 2½ to three inches per foot of grate length.

It was soon found, also, that the riser pipes in the rear water box were a source of trouble. Sometimes they became disconnected from the elbows, and when new grates were put in it was difficult to attach the elbows and risers, on account of interference with the other risers and with stay-bolts. When the risers were not connected, the grates burned off in a short time. This proved a serious difficulty, requiring in a number of plants the almost constant presence of boiler makers. Part of the boiler plant was therefore out of service a large portion of the time, and repair bills were large. Experiments were then made with other forms of construction, and a water box, or header, was finally adopted for the rear end, similar to that used for the front end of the grates, the space intervening between it and the shell of the boiler being built up solidly by a nine-inch firebrick wall. Connections were made from each end of the rear water box to the boiler shell, some distance back from the front of the boiler, and just below the water line. This expedient proved satisfactory, greatly reducing the number of tubes burning off.

This rear drum is now made in two forms. That adopted by the St. Louis manufacturers is simply a riveted drum 20 inches in diameter. This large radius permits the water grates to be screwed in, without the necessity of flattening the sides of the tube, as is customary with the form adopted by the Chicago manufacturers, whose rear drums are 10 inches in diameter. In the St. Louis form the drum is large enough to permit a man to enter it. By placing a light through a hand-hole into the front drum—which is usually eight or 10 inches diameter—it is possible to look through every tube, and thus ascertain its exact condition. The large drum, however, offers a favorable place for the accumulation of sediment, which may cause it to burn, on account of the high temperatures to which it is exposed. No such accident, however, has occurred, so far as I can learn. Fig. 2 shows the St. Louis form of construction. It shows but a single row of water grates, this form still being frequently used, as being easier to handle.

This cut also shows the present method of building the boiler fronts. In the early form, shown in Fig. 1, the ash-pit was wholly below the floor line, and was extended out in front of the boiler front, that portion of it being covered with sheet-iron plates, which were removed when cleaning the ashpit. This arrangement proving unsatisfactory, it was replaced by the three-door front shown in Fig. 2. This plan raised the average level of the upper grates to a point some 18 inches above that of the ordinary furnace, making it necessary for the fireman to lift the coal that much higher, and making the firing considerably more laborious. It has now become customary to raise the floor a little at a point some three feet away from the front (see heavy dotted line in Fig. 2), thus permitting the fireman to stand at the usual level with reference to height of grate. It is desirable also to have the ashpit slope to the rear, to facilitate cleaning.

As will be clearly seen from the drawings, the operation of the down-draught furnace is directly opposite to that of the ordinary setting. Very little air is admitted below the water grates; the entire supply of coal, and practically all the air, entering above. The fire burns downward instead of upward, there being "no thoroughfare" except downward through the grates. The gaseous products of combustion, together with the finely divided carbon particles which form the visible smoke, are forced through the incandescent mass of coal and are highly heated, after which they meet the equally hot flame from the lower grates, on which there is burning what is practically a coke fire. The combined water of the volatile matter in the coal, as well as its moisture, are decomposed into hydrogen and carbonic oxide gases. These combine with air supplied below the grate, or drawn downward through it, and burn, thus adding to the efficiency of the furnace instead of impeding it. The separated carbon meanwhile is transformed into carbonic acid gas, which is invisible. The result is almost complete combustion. Such little additional air as is needed is furnished through the registers of the doors between the two grates, or through those of the ashpit, the doors of which are sometimes left partly open also.

In practice it is found that, as an average, the upper grates do probably 90 per cent. of the work. When the boilers are not crowded little or no fuel is burned on the lower grates. When there is a demand for an increased amount of steam the fireman runs his slice-bar along or between the upper grates, causing a considerable amount of half-burned coal to drop through to the lower grates, where its combustion is completed.

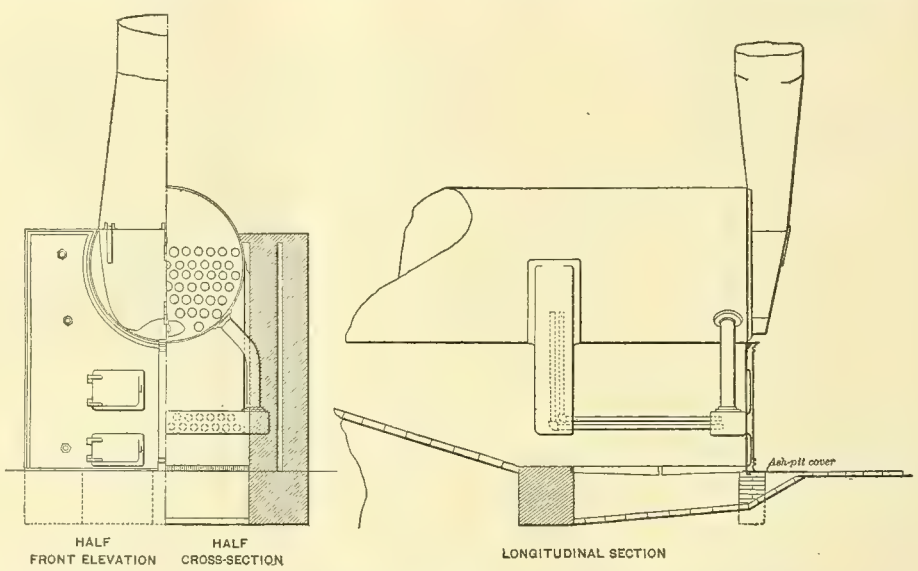



FIG. 1. DOWN-DRAUGHT FURNACE FOR STEAM BOILERS.—EARLY FORM DEVISED BY KEARNEY & HAWLEY.

It will be seen that the water grates and headers add somewhat to the heating surface, and thus increase the capacity of the boiler. It has been found, however, that this reversing of the path of the gases, and requiring them to traverse the tortuous passages, makes necessary a somewhat increased chimney capacity, if it is desired that the boilers be capable of doing as much work as with the ordinary setting. If the demand for steam never greatly exceeds the rated capacity of the boiler, the ordinary chimney will answer, it simply being necessary to carry thinner fires. The best results, however, in efficiency and smokelessness, as well as in capacity, are secured by having a chimney of ample height—a statement, however, which is equally true with regard to ordinary settings, which rarely have enough chimney.

In order to make a fair and definite comparison of the Hawley down-draught setting with the ordinary furnace, the Smoke Commission of the city of St. Louis, of which the writer is a member, made a competitive test at the plant of the William J. Lemp Brewing company, on July 11, 1893. The boilers were identical in every respect except as regards their furnaces, and that the chimney for the down-draughts was 143 feet high, and for the common battery 100 feet high, above grate level. The official reports of these tests are appended to this paper. (Table I.) It will be noticed that in both cases the boilers were run at more than double their normal rating, and that the efficiency of the Hawley was over 21 per cent. higher than that of the common furnace.

The smoke record, Fig. 3, shows reduction in the smoke of nearly 96 per cent. even under these extraordinarily severe conditions. Fig. 4 shows a chart made by the writer from the chimney of a Heine boiler, set with the Hawley furnace, at a time when the boiler was being run at 25 per cent. above its rating. It shows the remarkably low figure of only two-thirds of 1 per cent. of smoke—in fact, there was aboslutely no smoke except while the fires were being cleaned.

It will be seen in Figs. 1 and 2 that in the standard form of construction the fireplace is immediately under the front

1. Read at the Detroit meeting of the American Society of Mechanical Engineers

end of the boiler. This usually cuts off from 50 to 60 square feet of valuable shell heating surface, and, furthermore, must interfere largely with the circulation of the water in the boiler. In a few instances external fireplaces have been built, but their somewhat greater cost, the increased space occupied, the necessity for a special form of front, and the difficulty found in supporting the firebrick arches over the water grates, have prevented the general adoption of this plan. In my opinion, however, it possesses important advantages in capacity and efficiency, and should be followed wherever sufficient space is available.

With the present form of water-drums and tubes there is but little danger of the tubes burning out unless the feed-water is bad. This is a point that must be carefully looked into when it is proposed to use the down-draught furnace. It is a matter, however, that should always have attention, whatever the type of boiler or setting; and as there are now so many good systems of water purifications there is little excuse for permitting heating surfaces to become foul with

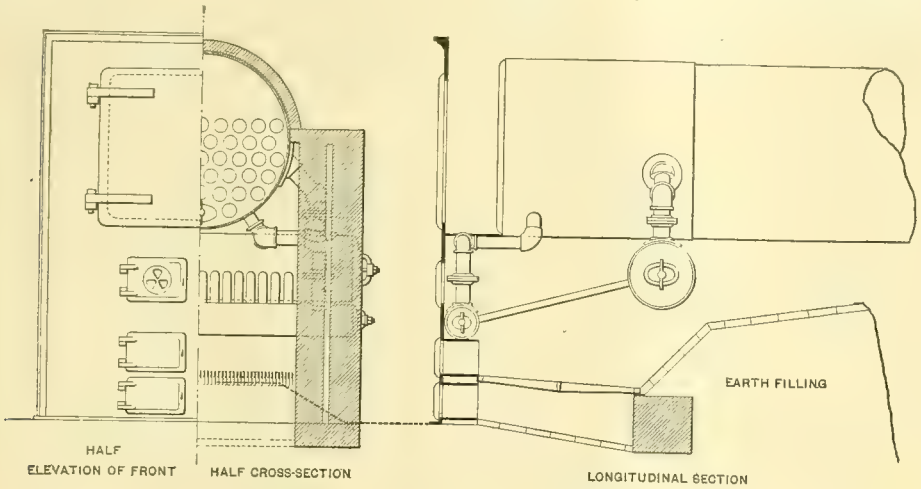



FIG. 2. DOWN-DRAUGHT FURNACE FOR STEAM BOILERS. IMPROVED FORM OF HAWLEY FURNACE.

scale. When the tubes burn out they do so without causing damage to the surroundings. Sometimes only the threads are stripped, and at other times the tube splits, resulting in a large, but not serious, leak of water. In such cases the boilers are generally run in their regular service until the usual time of shutting down, and cases are on record where the boilers have been run until Saturday night—almost a full week. It is desirable, however, that at least one side of the boiler be accessible, in order to afford access to both drums, particularly with bad feed-water. This necessitates a passage-way between each pair of boilers.

A few cases of grate renewals have been due to careless or ignorant handling of the slice-bar by the fireman, bringing a severe cross-bending strain on the tubes. This, of course, must be carefully guarded against.

There being considerable special ironwork connected with the Hawley setting, this type of furnace is necessarily more expensive in first cost than some others. Measured in results, however, the advantages would, in most cases, appear to warrant a considerably greater investment than is ever required.

The conditions under which it would appear unwise to use the Hawley down-draught furnace for smoke abatement would seem to be: First, where the feed-water is quite impure, and cannot be readily improved; second, where the feed-water is bad, and the boiler is not accessible from the side; third, where the draught is poor, and the boilers are hard worked; usually, however, the height of chimney can be increased; fourth, where there is but a single boiler; the possibility of an occasional tube renewal might cause the interruption of the service for several days; this danger would be very remote with reasonably pure feed-water; fifth, where the plant is of such a size or character as not to warrant the investment.

Evaporative tests made by myself and others indicate that the Hawley furnace adds to the efficiency of improved water-tube forms of boilers, although the percentage of increase is not so great as with the ordinary boilers. The design of the furnace is such as to make it readily applicable to any form of boiler.

I recently prepared a series of instructions to firemen for a large plant operating the down-draught furnaces. These are appended hereto. It will be seen that the requirements are not at all difficult of comprehension and execution.

In some cases the use of this furnace has been found to add to the labor cost. This was due in a few cases to the increased height to which the coal had to be lifted, and sometimes to the debilitating effect of the radiant heat pouring out through the open fire-doors into the face of the fireman. Raising the floor level has remedied the former trouble, and the latter has been largely reduced by an improved form of door, which can be so placed as to keep the heat off the fireman, while still admitting an ample air supply. In other cases the draught was insufficient, and large demands for steam have necessitated increased labor. In still other cases the firemen have not thoroughly understood the best method of handling the fires, and have not directed their efforts to the best advantage. With the latest form of construction, proper draught, intelligent and careful handling of the fires, there would appear to be no reason why the amount of labor should be increased. On the contrary, it ought to be decreased, as there is less coal to be handled.

Not the least of the many advantages afforded by the down-draught type of boiler furnace is the fact that the heating surfaces are exposed to practically constant temperatures. There is no alternate heating and cooling, as is the case with the common setting, when the doors are opened to admit fresh charges of fuel. That this type of boiler setting is destined to wide-spread use is demonstrated by the fact that three companies alone have within the last five years applied it to 1,600 boilers, aggregating 240,000 horse power.

While the Hawley type of down-draught furnace is perhaps the best known, others are coming into use, which promise well, although none have, as yet, met with very wide adoption. One of these, invented by Joseph M. Thomas, of St. Louis, is shown in Figs. 5 and 6. In essential characteristics it resembles the Hawley, the principal point of difference being the substitution of a series of firebrick arches in place of the water grates.

It possesses two important advantages: First, the absence of any connection with the pressure system of the boiler, thus avoiding trouble from that source; and, second, the brick arches act as reservoirs of heat, and do not cool the fires as the water grates do. It would be reasonable, therefore, to expect higher temperatures, and increased efficiency and smokelessness. Appended hereto are found the results of two tests made by the writer on boilers set with and without the Thomas furnace. My expectations as to smokelessness and efficiency were fully realized. I had expected some loss in capacity, due to the necessarily limited percentage of air space through the firebrick grates, but in this I was agreeably disappointed.

The difficulty with this setting thus far has been the short life of the grates, varying from 30 days to six months, depending entirely on the character of the service and the care with which the firing is done. Where the boilers are crowded, or where the firemen are careless, the arches last but a short time. If their durability could be increased to an average of, say, four months—which ought to be possible with careful handling, if the boilers are not unduly crowded—the small expense and trouble connected with their renewal would be fully warranted by the improved results. Experiments are now in progress with a view of securing a more highly refractory material out of which to make the grates, and until this is found, no extended effort will be made to push the introduction of the furnace.

Another form of down-draught furnace has been developed by J. A. Baldwin of Benton Harbor, Mich. It is similar in many respects to the Hawley, the principal difference being that, instead of admitting the air through open doors above the water tubes, it enters through ducts in the masonry side walls, thus being preheated to some extent. Part of this air is discharged above the water grates, and part below them. The lower grates, instead of being ordinary bars, consist of perforated wrought-iron plates. The preheating of the air should be an advantage, if it is not accomplished at the expense of some other desirable feature, such as smokelessness, capacity or efficiency.

Only a few of these furnaces have been built, and I have had no opportunity of examining them myself, but I am told that they are doing good work. No accurate evaporative tests have been made.

Another form is that invented by W. S. Plummer of St. Louis. Mr. Plummer has all his grate surface on one level, and divides it lengthwise into three parts. The two outer parts are of the ordinary pattern of up-draught grates, while the central portion consists of water tubes connected with the circulation system of the boiler. A solid brick wall blocks off the rear of the fireplace, and extends down to the bottom of the ashpit, except immediately under the rear end of the water tubes. There are two partition walls in the ashpit, running lengthwise, which separate the up-draught from the down-draught portion of the furnace. The firing is done just as in the ordinary furnace, but the only escape for the gases is downward through the central water grates. The plan is working satisfactorily on a small scale in St. Louis, and is now being applied to a large boiler plant, where its operation will be watched with interest. The difficulty would seem to be the necessity for great width of grate surface, it being necessary to get the entire amount of surface in one level, while, in the Hawley furnace, it is divided over two different parallel planes. An increase can, of course, be had by lengthening the grates, but this is not always desirable.

A somewhat similar form is that invented by E. M. Bosley of St. Louis, and applied in several cases in connection with his "incandescent" internally fired boilers. He divides his fire-box into two parts, with the dividing line at right angles to the center of the boiler. The front half consists of an ordinary up-draught grate. In the rear of this is a 10 inch front water drum or header, extending clear across the furnace, and connected by means of two-inch water grates to a similar drum in the rear. An ashpit of the usual form is built under the front grate, and a closing-off wall above the rear drum. The fire is burned on the front grate in the usual manner, a bed of fire being also carried on the water grates. The path of the gases is up through the front grate in the usual manner, and down through the water grates in the rear. A lower ashpit permits access from the front to the space underneath the water grates.

Both the Plummer and Bosley forms of down-draught furnaces appear to utilize the heating surface of the shell immediately overhead to better advantage than the Hawley, but, on the other hand, neither of them have the second grate located where it will catch and consume the droppings from the water grates. So far as I know no exhaustive investigations or tests of either of these types of setting have been made.

There are other types of down-draught furnace, notably that of Post & Sawyer of Boston, which I believe has been applied only in connection with their internally fired "complete combustion" boiler, and which does not use a lower grate. The other forms are, in general, modifications of those described here, being few in number and relatively unimportant.

The system in its best shape is not perfect. Much has been done during the last few years in improving details so as to increase the efficiency, durability and reliability of the apparatus, but there is room for further improvements. Even in its present content, however, it is well worthy of the careful study of progressive engineers everywhere.

INSTRUCTIONS FOR THE OPERATION AND CARE OF THE HAWLEY DOWN-DRAUGHT FURNACE, TO SECURE EFFICIENCY AND PREVENT SMOKE WITH ILLINOS COALS.

Fire frequently and in small quantities. Break up the lumps to fist size. Fire on the upper grates only, carrying a bed of uniform thickness over the entire grate surface. Avoid thin or bare spots.

The proper thickness of fire-bed depends upon the intensity of the draught and size of the coal. Lump coal and good draught require a thick fire, say eight to 10 inches, while fine coal and poor draught may render it necessary to reduce the thickness as low as four inches. Don't let the elevation of the grates at the rear deceive you, but be sure the thickness of the fuel-bed is the same there as at the front.

When slicing be careful that no green coal falls through to the lower grates. Do not let green coal get to the under side of the upper fire next to the water grates. When slicing push the bar between or along the water grates, and draw it back again without disturbing the fire. Lift the slice-bar just enough to break the caked bed. Use the slice-bar as little as possible. Be very careful not to strain the tubes with the slice-bar.

See that the bed of coal on the upper grates does not get either too thick or too thin. The former will reduce the capacity and the latter cause smoke.

Do not close the upper doors while fresh coal is on the fires.

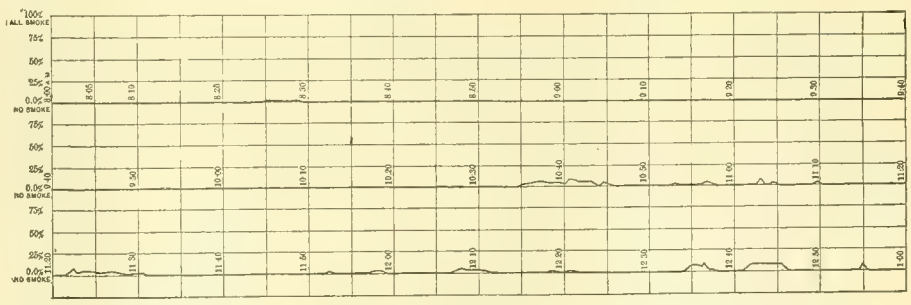



FIG. 3. DOWN-DRAUGHT FURNACE FOR STEAM BOILERS.—CHART SHOWING SMOKE RECORD.

Do not reduce the draught by closing the dampers, shutting the fire doors, or otherwise, except when absolutely necessary.

Keep the lower grates well covered, but do not let the bed get too thick nor permit clinkers to accumulate.

Keep the doors between the upper and lower grates closed, except when cleaning lower grates, say two or three times a day.

Admit a small amount of air under the lower grates, except when they are bare immediately after cleaning.

When cleaning the upper grates see that none of the water tubes are uncovered or exposed. The quantity and location of clinkers can usually be determined by running the slice-bar through the fire. They can then be loosened and hooked out without seriously disturbing the fire-bed. It is better to watch for clinkers closely and hook them out as fast as they are formed, rather than to attempt a general cleaning of the entire fire-bed at one time.

Do not clean the lower grates when there is much green coal on the upper grates. Immediately after cleaning slice

the upper grates carefully, so as to get a covering of live coals on the lower grates.

The ashpit should be cleaned as often as is necessary to keep it from filling up and obstructing the admission of air to the lower grates. Never clean the ashpit while the lower grates are bare or thinly covered.

Clean as quickly as possible, so as to avoid cooling the fires.

When cleaning the boilers see that the circulating pipes, and front and rear drums, to which the water grates are connected, are thoroughly washed out under pressure. Those parts which can be examined should be looked into at frequent intervals, and those which can be cleaned by mechanical means should have frequent attention. Where accessible the water grates should be washed out by inserting a hose into each one.

TABLE I.

RESULTS OF EVAPORATIVE TRIALS.—Made July 11, 1893, at St Louis, Mo., on Compromise boilers, with Hawley and common furnaces, at the Wm J Lemp Brewing association, by the Smoke Commission, City of St. Louis, to determine their efficiencies and smokeless ords.

| | Common | Hawley. |
|---|---|---|
| Kind of furnace | | |
| Number or other designation of trial | 1 | 2 |
| Duration hours | 10 | 8 |
| Number of boilers in operation | 2 | 2 |
| State of the weather | Clear. | Clear. |
| *Dimensions and Proportions.*—Kind of boiler | Hor. Ret. Flue. | |
| Dimensions of shell, diameter and length | 60″x24′ | |
| Number and diameter of tubes | 18—6″ | |
| Grade surface .area square feet | 58 | *52 75 |
| Water heating surface...square feet | 1879 | 1948 |
| Superheating surface....square feet | None. | |
| Ratio of grade surface to water heating surface.....1 to | 32 4 | 36.92 |
| Mean opening of damper (percentage of full opening) | 100 | |
| Chimney dimensions, height and diameter | 100x48 | 143x48 |
| *Average Pressures.*—Atmosphere as per barometer .inches | 30 05 | 30 05 |
| Steam in boiler, by gauge.....lbs | 97 85 | 99.53 |
| Steam in boiler, absolute.....lbs. | 112.55 | 114 23 |
| Draught suction....inches of water | 66 | .80 |
| *Average Temperatures.*—Of external air.....deg. Fahr. | 89 3 | 89 3 |
| Of boiler room.....deg. Fahr. | 90.5 | 96 5 |
| Of escaping gases entering chimney.....deg. Fahr. | 542.5 | 540 |
| Of feed-water entering boiler. deg. Fahr. | 167 4 | 162 96 |
| Of steam in boiler.....deg. Fahr. | 336. | 337.30 |
| *Fuel.*—Kind of coal | Gillespie. | |
| Size of coal | Small Lump. | |
| Cost per ton of 2,000 lbs., delivered. | $1.75 | |
| Calorific power by calorimeter, B. T. U.....per lb. | 9;22 4 | 9076.2 |
| Theoretical evaporative power, from and at 212 deg. Fahr., in lbs. water per lb. coal | 10 07 | 10.33 |
| Total quantity consumed.....lbs. | 24,000 | 17,200 |
| Total ash, clinkers, and unburned coal.....lbs. | 3204 | 2462 |
| Proportion of ash, etc, to coal .....per cent. | 13 35 | 14 31 |
| Unburned coal in ash.....lbs. | 1008.3 | 615 |
| True ash.....lbs. | 2195.7 | 1847 |
| Total combustible burned.....lbs. | 20,796 | 14,738 |
| Mean thickness of fire.....inches | 6 | 9 to 10 |
| *Combustion per Hour.*—Coal actually consumed.....lbs. | 2400 | 2150 |
| Combustible actually consumed. lbs. | 2079 6 | 1842 25 |
| Per square foot grate surface, coal .....lbs. | 41 38 | 40.76 |
| Per square foot grate surface, combustible.....lbs. | 35 85 | 34 92 |
| Per square foot heating surface, coal.....lbs. | 1 277 | 1.10 |
| Per square foot heating surface, combustible.....lbs. | 1 11 | 95 |
| *Calorimetric Tests.*—Quality of the steam (dry steam = 1) | Dry. | |
| Amount of water entrained in the steam .....per cent. | None. | |
| Amount of superheating..deg. Fahr. | None. | |
| *Water.*—Amount apparently evaporated.....lbs. | 125,982 | 111,613 |
| Amount actually evaporated (corrected for entrainment) ... .lbs. | 125,982 | 111,613 |
| Factor of evaporation | 1 086 | 1.091 |
| Equivalent evaporation into dry steam from and at 212 deg. Fahr. .....lbs. | 136,816 45 | 121,769.78 |
| *Economic Evaporation.*—Per pound of coal: Water actually evaporated (corrected for entrainment)....lbs. | 5 249 | 6.489 |
| Equivalent from and at 212 deg. Fahr.....lbs. | 5 700 | 7 079 |
| Per pound of combustible.—Water actually evaporated (corrected for entrainment).....lbs. | 6.058 | 7.57 |
| Equivalent from and at 212 deg. Fahr..... .....lbs. | 6.560 | 8 262 |
| *Evaporation per Hour.* Water actually evaporated (corrected for entrainment).....lbs. | 12,508.2 | 13,951.6 |
| Equivalent from and at 212 deg. Fahr.....lbs | 13,681 6 | 15 221 2 |
| Per square foot heating surface — Water actually evaporated (corrected for entrainment).....lbs. | 6.705 | 7.162 |
| Equivalent from and at 212 deg. Fahr..... .....lbs. | 7 281 | 7 814 |
| Per square foot grate surface — Water actually evaporated (corrected).....lbs. | 217 21 | 264 48 |
| Equivalent from and at 212 deg. Fahr.....lbs. | 235 89 | 288 55 |
| *Efficiency.* Percentage of total calorific power utilized, or efficiency.....per cent. | 56 60 | 68.53 |
| *Horse Power.* Actually developed on basis of 34½ lbs. water evaporated per hour from and at 212 deg. Fahr. .....horse power. | 396 57 | 441.19 |
| Commercial rating.....horse power. | 188 | 207 |
| Proportion capacity developed is of commercial rating.....per cent. | 210 9 | 213.1 |
| Heating surface required to develop 1 horse power. .....square feet. | 4 74 | 4 41 |
| *Smoke Record* Mean smoke production, on a scale of 100 | 74 16 | 3 19 |
| Reduction of smoke by furnace being tested.....per cent. | | 95 67 |

*Upper grate only.

*Analyses* (Average).—Coal:

| | | |
|---|---|---|
| Moisture | 8.60 | 8 84 |
| Volatile Matter | 29.506 | 29.858 |
| Fixed carbon | 50.304 | 48 452 |
| Sulphur | 1 360 | 1 58 |
| Ash | 10.23 | 11 27 |
| Refuse (ash, clinkers, unburned coal, etc.). | Red to dry weight | |
| Moisture | | |
| Volatile matter | 1 91 | 1. |
| Fixed Carbon | 29 56 | 23.98 |
| Ash | 68.53 | 75.02 |
| Gases: | | |
| Hydro carbons | None. | None. |
| Carbonic oxide | 43 | .14 |
| Carbonic acid | 5 41 | 7.61 |
| Oxygen | 9.77 | 9.52 |
| Nitrogen (by diff.) | 84 39 | 82.73 |

TABLE II.

RESULTS OF EVAPORATIVE TRIALS.—Made February 11 and 12, 1895, at St Louis, Mo., on horizontal flue boilers, with and without the Thomas smokeless furnace, at Christy Fire Clay Works, for Thomas Furnace company, to determine their capacity and efficiency.

| | Common. | Thomas. |
|---|---|---|
| Kind of furnace | | |
| Number or other designation of test | 1 | 2 |
| Duration hours | 9 | 9 |
| Number of boilers in operation | 2 | 2 |
| State of the weather | Fair. | Snowing. |
| *Dimensions and Proportions.*—Kind of boiler | Hor. Flue. | |
| Dimensions of shell diameter and length | 48 x20 | 46 x20′ |
| Number and diameter of tubes | 4x11″ | 4x10 |
| Grate surface, 9 67′ wide, 4′ long. .....area square feet. | 38.67 | |
| Water heating surface.....square feet. | 795 | 659 |
| Superheating surface .....square feet. | None. | |
| Percentage of air space in grate per cent. | 45 | 31 68 |
| Ratio of grate surface to water heating surface .....1 to | 20.56 | 17.05 |
| Mean opening of damper (percentage of full opening) | 100 | |
| Chimney dimensions, height and diameter | 60 x30″ | |

*Water.*—Amount apparently evaporated.lbs. 46,350 43,739
Amount actually evaporated (corrected for entrainment).....lbs. 46,350 43,739
Factor of evaporation..... 1.2014 1.2012
Equivalent evaporation into dry steam from and at 212 deg. Fahr.....lbs. 55,685 52,539

*Economic Evaporation.*—Per pound of coal: Water actually evaporated (corrected for entrainment).....lbs. 4.47 5.47
Equivalent from and at 212 deg. Fahr. lbs. 5.37 6.57
Per pound of combustible —Water actually evaporated (corrected for entrainment).....lbs. 5.25 6.28
Equivalent from and at 212 deg. Fahr. lbs. 6.30 7.54

*Evaporation per Hour.* Water actually evaporated (corrected for entrainment).....lbs. 5,150 4,850
Equivalent from and at 212 deg. Fahr. lbs. 6,187.2 5,837.7
Per square foot heating surface.—Water actually evaporated (corrected for entrainment).....lbs. 6.48 7.37
Equivalent from and at 212 deg. Fahr. lbs. 7.78 8.86
Per square foot grate surface.—Water actually evaporated (corrected)...lbs. 133.18 125.67
Equivalent from and at 212 deg. Fahr. lbs. 160. 150.96

*Efficiency.* Percentage of total calorific power utilized, or efficiency.....per cent. 46.71 57.5
Water evaporated for $1 worth of fuel. lbs. 6,504 7,959
Cost of evaporating 1,000 lbs. of water .....cents 15 38 12 56
Coal consumed per horse power per hour.....lbs. 6.43 5.25
Increase of efficiency made by the Thomas furnace..... 22.4

*Horse Power.* Actually developed on basis of 34½ lbs water evaporated per hour from and at 212 deg. Fahr.....horse power 179.34 169.18
Commercial rating, at 7½ square feet heating surface.....horse power 106 87 85
Proportion capacity developed is of commercial rating.....per cent. 169.19 192.56
Heating surface required to develop 1 horse power.....square feet 4.43 3.89

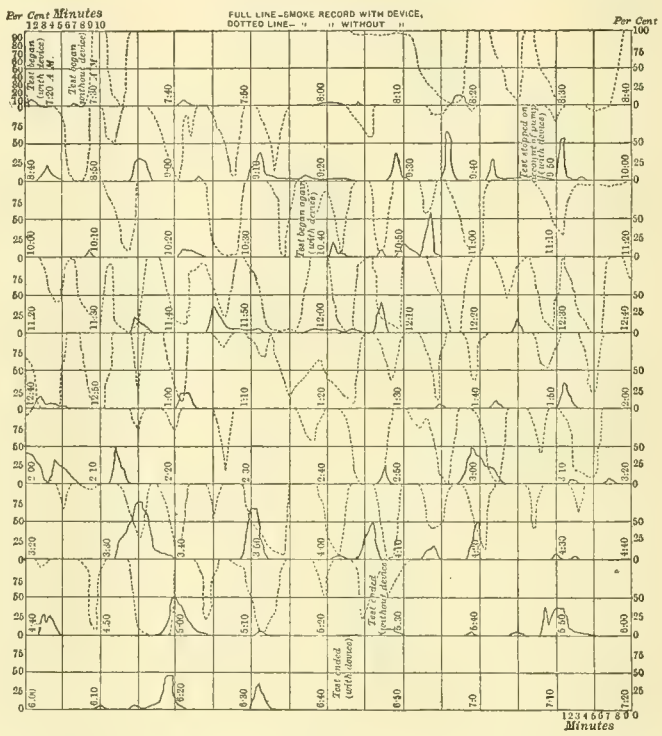



FIG. 4. DOWN-DRAUGHT FURNACE FOR STEAM BOILERS.—SMOKE CHART OF HAWLEY FURNACE WHEN BOILER WAS RUN 25 PER CENT ABOVE ITS RATING.

*Average Pressures.*—Atmosphere, as per barometer.....inches 29 681 29.476
Steam in boiler, by gauge .....lbs. 77 55 74 40
" " " absolute .....lbs. 92 35 89.10
Draught suction.....inches of water .3733 4097

*Average Temperatures.*—Of external air .....deg. Fahr. 23.25 21.60
Of boiler room.....deg. Fahr. 45.22 62.51
Of escaping gases entering chimney .....deg. Fahr. About 900 618.24
Of feed water entering boiler. deg. Fahr. 51 86 51.89
Of steam in boiler.....deg. Fahr. 322 319

*Fuel.*—Kind of coal..... Mount Olive.
Size of coal..... Lump.
Cost per ton of 2,000 lbs., delivered..... $1 375
Calorific power by calorimeter. B. T. U. .....per lb. 11,100
Theoretical evaporative power, from and at 212 deg. Fahr., in lbs. water per lb coal..... 11 49
Total quantity consumed..... lbs. 10,375 8,000
Total ash, clinkers and unburned coal .....lbs. 1,540 1,036
Proportion of ash, etc., to coal..per cent. 14.84 12 95
True ash.....lbs. 1,048 808
Total combustible burned.....lbs. 8,835 6,964
Mean thickness of fire.....inches 6 8

*Combustion per Hour.*—Coal actually consumed.....lbs. 1152 8 888 88
Combustible actually consumed....lbs. 931 7 773 77
Per square foot grate surface, coal. lbs. 29 81 22 99
Per square foot grate surface, combustible.....lbs. 25 39 20 01
Per square foot heating surface, coal. lbs 1 45 1.35
Per square foot heating surface, combustible..... lbs. 1 235 1 185

*Calorimetric Tests*—Quality of the steam (dry steam — 1)..... Dry.
Amount of water entrained in the steam .....per cent. None.
Amount of superheating.....deg. Fahr. None

*Analyses* (Average).—Coal:

| | |
|---|---|
| Moisture | 12 04 |
| Volatile matter | 32 95 |
| Fixed carbon | 41 63 |
| Sulphur | 3.28 |
| Ash | 10.10 |
| | 100. |

## National Electric Light Association.

It is officially announced that President Wilmerding has called a meeting of the executive committee of the National Electric Light association, to be held in New York on Tuesday, September 10th, for the purpose of discussing the advisability of holding an electrical exhibition in connection with the next convention. He has also sent out a circular letter to supply men, in which he discusses the prospects for a successful undertaking of this kind. Following is a copy of the letter:

It has been suggested that an electrical exhibition be held in connection with the next annual convention of the National Electric Light association, which will take place next May in New York. The executive committee of the association proposes to act very shortly on this proposition, but before doing so I feel that we should obtain an expression of opinion from those to whom we should look for the very essential features of such an undertaking, namely, the exhibits. The intention is that, in case such an exhibition is held, it shall be something of considerably more importance than any of the exhibitions that have been made in connection with previous conventions of this association; and unless we feel assured that there is a very general desire on the part of manufacturers to enter into such a project

and to give it their hearty co-operation we should prefer that the matter be dropped.

I should, therefore, esteem it a favor if you would reply, stating what your views in general on this subject are, and whether there would be a reasonable chance of your taking part in such an exhibition.

## Will the Courts Confirm Monopoly of Street Railway Privileges?

Another step in the important litigation between the Chicago General Street Railway company and the Chicago City Railway company, to determine the right of one company to use the tracks of another company, has been decided upon by the first named corporation. With a view to contesting each adverse point in the recent decision handed down by the Circuit Court in the case of the Chicago General Street Railway company against the Chicago City Railway company, the former company will shortly institute a suit against some firm whose traffic wagons have used its tracks. The suit will be based on Judge Tuley's decision that tracks are private property. The principle laid down in the decision is against the stand the complainant company has always taken. The suit will be begun almost with the expectation of defeat, and if it be thus terminated it will strengthen the company's position in its fight against the principle of private ownership of street car tracks. In the suit the company will assume the decision of Judge Tuley, for the time being, to be law, and quote it accordingly. The decision says that the company has a property right in the rails "and the uses thereof, of which it cannot be deprived except upon just compensation as ascertained (and paid), as provided by law. The property right is entitled to protection as private property, which cannot be taken for public use without compensation." Acting on this theory the street car company will bring suit against some firm whose wagons use its tracks, and will ask for compensation for the use of its private property.

"If the law will help us in establishing a monopoly," said C. L. Bonney, vice-president of the road, "it is well to know it. If street car tracks are private property, then no one has a right to use them without compensating the owners. At least that is what the recent decision says. The position our road has always assumed is that tracks are public property as much as the highway on which they are laid. If we win the case we intend to bring suit against some firm for, say, $1,000 for the use of our tracks—a precedent will have been established that will be of intense interest to every street car company in existence. We do not expect to win it, because we do not think the opinion in that respect is just. But for the sake of determining what the law is on the subject, the case will be brought. We are in this position: If we win, and according to the decision of the court the argument is sound, street car property will be increased a hundred fold in value. And if we lose, which we expect to do, a portion of the decision of the court will be overruled and our main case with the other company will be strengthened a great deal.

"Just as an instance of the absurdity of the question, take this view of it: A street car company's tracks cross a bridge and take up all the room devoted to driving. Any one who desired to cross that bridge with a horse could only do so by trespassing on the car tracks, which, according to the court, are private property. If these tracks are private property, certainly no one has a right to cross them without paying for the privilege. Several bridges in Chicago are in that situation.

"In his opinion Judge Tuley cited a case in New Jersey which held that a coach or omnibus company would be enjoined from using the rails of the horse railway company in competition with the horse railway. That is practically in the same boat with the other case. If an omnibus company should use our tracks we could enjoin them from doing so, according to that, on the grounds of their entering into competition with us.

"All these facts are directly opposed to the position we have assumed in regard to the vested rights of street car companies, and we do not think they will be upheld by a higher court. The state constitution says all railways constructed in this state are 'public highways, and shall be free to all persons and property thereon under such regulations as may be prescribed by law.' We construed this to mean that they are public highways in the same sense as streets are, but the court held differently. The decision says the Chicago City company has laid the tracks and run its cars over them for several years, and that it has obtained not only a binding contract with the city under the decisions of the Supreme Court, but an easement in the street, and has a property right in the rails so laid and the uses thereof of which it cannot be deprived except upon just compensation. To hold otherwise would be to hold that the vast interests of horse railroads in the city, amounting to many millions of dollars, are held subject to the whim, caprice or mercy of the city.'"

Mr. Bonney said the case against the Chicago City Railway company would be carried to the Appellate Court this fall.

## Berliner Telephone Litigation.

Advices from Washington indicate that the government has under consideration the question how further to proceed with the case against the American Bell Telephone company for the repeal of the Berliner patent. As the case now stands, the bill of the government has been dismissed by the Court of Appeals for the First Circuit, and under that judgment the Bell company has begun proceedings against several of the corporations which entered the telephone field after the expiration of the Bell patent in 1893. The validity of the Berliner patent is essential to the further control of the telephone business by the Bell company, and the present situation is of additional interest from a legal or judicial view, because the case involves a consideration of the act of 1891 establishing Circuit Courts of Appeal.

The prayer of the bill in the case, which was filed in the Circuit Court in Boston, February 9, 1893, by order of Attorney-general Miller, was that the patent issued to Emile Berliner and assigned to the Bell company be repealed on the ground (1) that it was covered by a previous patent issued November 2, 1880, to Berliner for electric telephone, and (2) that the issue of the patent was unlawfully delayed by the Bell company from 1877 to 1891. On December 18, 1894, Judge Carpenter of the Circuit Court announced his judgment sustaining the prayer of the United States declaring the patent null and void. The case was appealed to the Circuit Court of Appeals, and on May 18th last Judges Colt, Putnam and Nelson united in reversing the judgment of Judge Carpenter, and remanding the case to his court, with instructions to dismiss the bill, thus sustaining the validity of the patent.

By the terms of the act creating Circuit Courts of Appeal the judgment of those courts is final in all cases arising under the patent laws, except where the judges certify a case to the Supreme Court, or where the Supreme Court directs the case to be brought before it for review on a writ of certiorari. The Telephone company is evidently inclined to accept the decree of the Court of Appeals as final, and is proceeding to enforce its claims under the patent. But the government representatives say that a case involving the question whether or not the United States has the right to sue for cancellation of a patent is vastly different from a controversy between two private parties over a patent right, and that upon that point an appeal will lie to the Supreme Court from the judgment of the Court of Appeals. And even if that ground should fail them, they can sue for a review of the case on a writ of certiorari as provided in the law itself. Which method of procedure will be followed has not yet been finally settled, but it is asserted that the case will not be permitted to rest in its present condition.

## Philadelphia Street Lighting.

Philadelphia has probably more arc lamps on its streets than any other city in the country. On December 31st last the number was 5,392. The work of testing these lamps is given considerable attention, but evidently not without good cause, as the following results of tests, published in *Municipality and County*, show:

| Company | Amp. | Volts. |
|---|---|---|
| Brush | 9.11 | 47 2 |
| Diamond | 8 5 | 48 3 |
| Kensington | 8 45 | 42.55 |
| Manufacturers | 9 25 | 42 7 |
| Powelton | 8 5 | 35.8 |
| Southern | 8 55 | 43 9 |
| Suburban | 8 5 | 49 6 |
| Wissahickon | 8.87 | 44 |
| Total | 69 73 | 354 05 |
| Average | 8.71 | 44 25 |

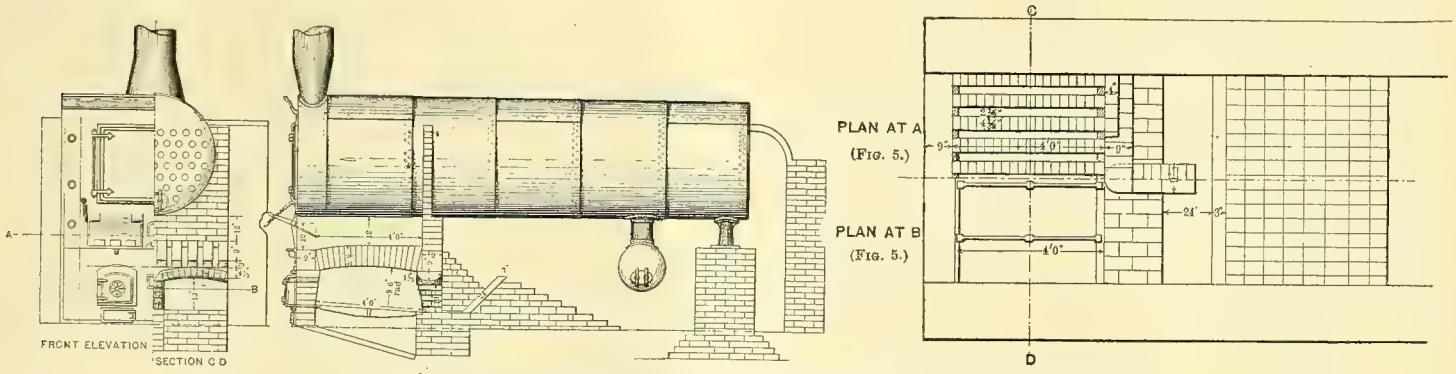
As the contract calls for 9.6 amperes and 47 volts, or 451 watts, it will be seen that the mean average of the tests is below the standard as much as 66 watts. These tests were made at all hours of the night, and at times unknown to the company. In consequence of this laxity the department made a marked deduction from the bills of the companies, and caused the efficiency to be brought up to the required standard.

## Long Condensing Water Tunnel.

The Metropolitan West Side Elevated Railway company of Chicago is constructing a tunnel from its power plant at Throop and Loomis streets to the Chicago river at Van Buren street, to supply its steam plant with water for condensing purposes. The Metropolitan "L" will have the most extensive private tunnel in the city and the work of building it will go on for the next six months.

The conduit will be 30 feet under the surface of the ground. Its length will approximate 6,000 feet and its diameter will be five feet. This large diameter was adopted, the officials say, not only for the purpose of securing a sufficient quantity of water, but in order also to allow the work of excavation to be carried on to advantage. Brick and Portland cement are the materials that will be used in the construction of the conduit. The tunnel will follow the line of the elevated road and extend immediately under the center of that structure the entire distance. It is estimated that 6,000 gallons of water per minute will be taken from the conduit and condensed. The water from the conduit will not be used for any other than condensing purposes.

"It is a question of economy, principally," said an official of the road. "We have no doubt that a very considerable saving will result, sufficient to justify such a heavy undertaking. The work will be pushed as rapidly as possible, and we hope to have the conduit completed in six months. For all other purposes but condensing we shall get our supply of water from the city pipes. Although the distance is somewhat long, this was the only means by which we could get a sufficient supply of water to operate the system. The engines at our power plant were purchased with the definite plan of operating them in this way."




FIGS. 5 AND 6. DOWN-DRAUGHT FURNACE FOR STEAM BOILERS.—TYPE INVENTED BY J. M. THOMAS.

## American Electro-therapeutic Association.

The programme for the fifth annual meeting of the American Electro-therapeutic association, at Toronto, Ont., September 3d, 4th and 5th, has just been issued, and shows that of a very interesting session has been arranged. There will be an exhibition of modern electrical apparatus, such as batteries, static machines, meters, current controllers, electrodes, etc., as well as other instruments, held in Reception Hall, adjoining the meeting room of the association.

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COMMENTING upon the proposition to establish trolley funeral trains, a Chicago evening paper quotes a local street railway magnate in support of the statement that the conditions are such that these funeral trains in the southern portion of the city will soon become not only very desirable on account of the economic reasons, but attractive from a common-sense view; and the writer adds: "But great difficulty will be encountered in the attempt to popularize funerals of any kind."

GOOD news comes from Washington in the form of press dispatches, in which the government is reported to be considering the best means of taking up the Berliner case and pressing it for final adjudication. The right of the government to sue for cancellation of a patent is the point which, it is thought, the Supreme Court should pass upon. If the Circuit Court of Appeals refuse to certify the case for review, the government proposes to apply for a writ of certiorari. All of which is very encouraging to those who believe that the American Bell Telephone company has had ample protection under the patent laws, and that the time has come for opening up the telephone field to the world.

MILWAUKEE newspapers note the fact that the aldermen to whom the application of the new electric railway company for franchises have been referred have discovered that the streets which the new company proposes to occupy are too narrow for such purposes. The old company found no trouble in operating its cars in streets of similar width. But then it makes a difference whether it is Herr Payne or Larry McGann who wants the franchise. There is one thing the council should do, and that is insist upon the adoption of an appropriate style of construction for all new lines, regardless of the company building them. The interests of the street railway men will best be served by providing an overhead construction that will not be offensive to the eye. A good rule would be to select a few of the present routes in Milwaukee and make the proposed lines as unlike them as possible.

ACCORDING to the circular letter just issued by the National Electric Light association, President Wilmerding has very wisely decided to secure an expression of opinion from supply men and manufacturers upon the subject of holding an electrical exhibition before committing the organization to any plan of project. Of course some sort of an exhibition will be held in conjunction with the next convention, and the only question is as to the character of the display and whether it shall be conducted upon a magnificent scale or be of modest proportions. At a recent meeting of electrical representatives in New York the opinion prevailed that it was time for that city to have a big electrical display, and that the convention next May would afford an excellent opportunity and provide ample time for arrangements. It would, of course, be a big undertaking, and should not be considered unless those in charge were willing and able to devote the necessary time, labor and money to make it all that its advocates claim for it. The matter should be carefully considered in all its bearings before definite action is taken.

IT seems rather strange that only within the last week has there been direct telegraphic news connections between Mexico and this country, but such is the case, and the credit of bringing the capitals of these republics into closer relations is due to the Associated Press and the Western Union Telegraph company. The leased wire system has been extended from San Antonio to Laredo, Tex., on the border of Mexico, where connection is made with the system of the Mexican National Railway company. The full report of the Associated Press will hereafter be sent direct to the capital of Mexico, where it will be published by the leading paper of the republic. The Associated Press will also receive the news of Mexico, and at the headquarters in Chicago it is contemplated to deliver this news in New York and San Francisco within 10 minutes of its filing. Hitherto the dispatches between this country and the City of Mexico have traveled a roundabout way. Some of them came by Laredo, Tex., overland, and others traveled under the waters of the gulf to Galveston and then began their long journey to the East. The way was devious and much valuable time was lost. Comparatively little attention has been bestowed upon our southern neighbor, but now that facilities for intercommunication are at hand, it is hoped that both countries will profit by the arrangement. It is a victory for the telegraph, and it means much to both nations.

IN these days of fads it is not surprising to find the women of fashionable society in large cities indulging in all sorts of adventures that give promise of bringing them into public notice. It is true that most of these are undertaken under the guise of charitable movements, and that is probably the only reason that the more sedate and conservative element is reconciled to the spectacle. Living pictures and Trilby readings have been done to death, and now more exciting and realistic adventures are sought. One of the latest fads is the running of trolley cars by women for the benefit of some charitable institution. In several cities during the last few weeks prominent local society women have made arrangements with the management of street railroad companies to place the cars under the control of women on some particular day, the proceeds to go to the benefit of certain charitable enterprises. It seems hardly possible that any street railway company in the country would so far disregard its obligations and responsibilities as to place its cars in charge of persons without any training or experience in handling motor cars, but announcement has been made of several cases of this kind. This seems to be too much in the nature of inviting accidents. Street railway companies should not forget that they are responsible to the communities in which they operate, and that they ought not do anything that will endanger life or property.

THERE is a good deal of speculation as to the reason for Superintendent Barrett's interest in the movement for an underground electric conduit railway system for Indiana avenue. It is not strange that the city electrician is opposed to an overhead trolley system, for it is generally understood that he has disposed of all, or nearly all, his interest in similar enterprises. But why this pernicious activity in behalf of a conduit system? It would seem that that experience with the Love conduit, which he approved so highly, and which in practice proved so unsuccessful, would convince him that he was entirely out of his element in passing upon such plans. Can it be possible that the "professor" has made a new "combination" and has undertaken to boom a new scheme? Many vague and indefinite promises are repeated by those advocating a conduit system as coming from Superintendent Barrett, but upon whose authority these promises are made does not appear. Before attaching too much importance to the endorsement of the city electrician, the property owners of the street should secure the report of a competent engineer, otherwise they may find themselves burdened with an experimental road like that which Mr. Yerkes was induced to put down on the Webster avenue loop. Superintendent Barrett's efforts in solving the underground electric conduit railway problem have proved an ignominious failure, only second in extent and importance to his most remarkable record in connection with city lighting.

ANOTHER case in which a person receiving a severe shock from contact with an electric wire carrying a powerful current was resuscitated is reported from Rochester, N. Y. It is somewhat similar to the Grover case, reported a short time ago. The victim in the first accident received a heavy current of electricity and was seemingly dead for nearly an hour, but his comrades worked faithfully over him and restored him to consciousness. Last week at the same place Harry W. Sherman received a very heavy shock, precisely how heavy is a matter of conjecture, but certainly heavy enough, so far as appearances went, to kill him, and his comrades, under the direction of Superintendent Redman, went to work at him skilfully and restored him in six minutes. During that time he was virtually dead, and if no steps had been taken to resuscitate him he would have been actually dead in a short time. These two cases have naturally attracted much attention, and have revived the doubts of many as to the certainty of action of electric currents. One contemporary inquires: "What is the use of the old theory that an electric shock kills when a man like Superintendent Redman, familiar with electricity in a practical way from boyhood, quietly sets his employes to work, as a matter of course, on an apparently dead comrade and brings him back to life." And it adds: "The plain facts are that a heavy electric shock may kill and may not kill, and that the only way to know whether it has killed or not is to apply the test of an attempt at restoration." The Legislature of New York cannot afford to disregard this matter. It should provide some other form of inflicting capital punishment as long, at least, as there is any doubt as to the present method.

GENERALLY speaking, mention of the street railroad lines of Chicago is taken as reference to the lines of the Chicago City Railway company, or what is known as the "South Side cable system," and the North and West Chicago Street Railroad companies, or the "Yerkes lines." But these do not include all the street railway lines of the city of Chicago. On the North and West Sides, for instance, there are numerous independent electric lines, acting as feeders for the cable systems, but operated independently and extending out into the suburbs in every direction. Very few persons who have not had occasion to give this subject special attention realize the extent and magnitude of these enterprises or their prospects. The rapid development of the districts along the lines of these trolley roads gives some idea of what may be expected during the next ten years. The same condition of affairs is found on the South Side. Beyond the district covered by the Chicago City Railway company's lines there is a rapidly developing territory covered by a network of electric lines that give quick and cheap service. These roads are owned and operated by several smaller companies, entirely independent of the cable system, and while they are even now considered good investments, it is believed that by effecting a combination they would become very much more valuable. This view has been entertained by the management of these roads and there is a movement now in the direction of consolidating the electric interests in the Calumet district. The Calumet Electric Street Railway comyany has leased the road built by W. V. Jacobs and known as the Englewood & South Chicago Street railway. This road starts from the Alley Elevated Station at South Park avenue and Sixty-third street and runs south to Sixty-seventh and east on Sixty-seventh to Cottage Grove avenue. There is another line south on South Chicago avenue to Cottage Grove. By combining all of these interests in this district a very important company could be established. Taking everything into consideration, the track mileage, number of cars, extent and importance of the territory served and the prospective development, such a company would rank among the leading street railway enterprises of the country.

## Production of Aluminum.

The Geological Survey will soon issue a review of the mineral resources of this country, and among other things treated, it will show that the production of aluminum has grown from 83 pounds in 1885 to 550,000 pounds in 1894.

The first step toward the production of aluminum for industrial purposes in this country was taken in 1885 by the Cowles Electric Smelting & Aluminum company of Cleveland, Ohio, which began to make aluminum bronze in that year. The Cowles process attracted much attention, as it was the beginning of dynamo-electro-metallurgy in the United States. The commercial product was aluminum alloys and not metallic aliminum. This process consisted in reducing alumina in the presence of charcoal and granulated copper by a current from a powerful dynamo-electric machine. An oblong receptacle or furnace of fire brick lined with carbon and provided with a suitable cover was employed; through the ends of this the large electrodes of the dynamo were fitted. The mixture of alumina, charcoal and granulated copper was introduced into this receptacle between the electrodes, and the current was turned on. Under these conditions the alumina was reduced to a melted mass which formed an alloy with the copper, which was melted by the heat produced in the furnace, and this alloy, being rich in aluminum, was afterward remelted and enough copper added to make the bronze of the desired percentage of aluminum, 5 or 10 per cent., as the case might be.

The Cowles company made between 4,000 and 5,000 pounds of this bronze in 1885, which was sold at 40 cents a pound. Much was expected from this bronze, and the list of uses proposed for it covered a wide range, from ordnance to small fancy articles. Its tensile strength was found to vary with the varying amounts of aluminum, from 53,000 to 72,000 pounds per square inch. Besides aluminum bronze, the Cowles company also made aluminum brass; that is, copper and zinc alloy containing aluminum. This alloy became of considerable metallurgic value in the next few years because it was used as a vehicle for introducing small quantities of aluminum into molten iron and steel.

In 1886 the Cowles company produced 50,000 pounds of aluminum bronze. The tensile strength of wrought iron treated with aluminum was said to be increased, so with this feature, together with the faculty of casting, it was expected would give to the furnace a power to produce iron equal to mild Siemens-Martin steel. The addition of one per cent. of aluminum to steel was found to effectually prevent the formation of blow-holes. The tensile strength of the steel was considerably increased.

Up to this time aluminum for commercial purposes in the United States had not been produced, but in 1888 the Hall process of obtaining aluminum by electro-metallurgy was put into operation by the Pittsburg Reduction company of Pittsburg, Pa. Up to May, 1889, the production of aluminum by this process was 3,500 pounds, which sold at $5 per pound for ingots and from $7 to $9 in sheets in 1888, but early in 1889 the price fell to $2 for ingots. The production of aluminum in 1889 was 19,200 pounds; and in 1890 it was 47,880 pounds, and the price fell below $2.

The discovery of large and workable deposits of bauxite in Georgia and Alabama, which began to be worked in 1891, showed that abundant "ore" of aluminum exists in this country. In that year the production of aluminum was greatly increased, both here and in Europe, and amounted in this country to 150,000 pounds, including that contained in alloys. In 1892 the production of aluminum in this country amounted to 259,885 pounds, and in 1893 to 333,629 pounds, including alloys, the greater part of which was metallic aluminum.

The aluminum industry in the United States has become of considerable and growing importance, and the manufacture has grown from nothing until the value of the output amounts to over $200,000 per annum, while the price has fallen to one-tenth what it was in 1888.

Experiments were made in England to discover the cause of the changes produced in iron and steel by the small quantity of aluminum (one per cent.) added to the mould before casting. These experiments were described by R. A. Hadfield in a paper read before a meeting of the Iron and Steel Association, showing that the prevention of blow-holes in castings and dispossessions of graphitic carbon may be to the reducing action of the aluminum, direct experiments having proved that the mould will decompose carbon oxide at a very high temperature, taking up its oxygen and setting its carbon free. This would prevent the escape of gas in molten iron or steel and so prevent blow-holes. Mr. Hadfield likened the action of aluminum to that of silicon at a high temperature.

An aluminum torpedo boat was built in 1893 by Yarrow & Co. for the French government. She was 60 feet long and nine feet three inches in diameter. Her weight, with machinery on board and boilers full of water, was 9½ tons, and she made 20.5 knots. There was also a 10-ton yacht and a 33-foot sailing boat built in France of aluminum, and aluminum boats for the Wellman Artic expedition were made in Baltimore.

It has been claimed that aluminum would be available as a valuable material in the construction of naval vessels. This claim was urged so strongly and brought so persistently before the officers of the navy that they decided to make tests of the metal. Specimens of aluminum were submitted to tests in salt water, and the naval officers who have examined these specimens say that the metal will not be available for use in the construction of naval vessels, because, after being in salt water for any length of time, it crumbles to pieces. It cannot withstand the action of salt water, and it is believed that only one metal known to science will thoroughly do this, and that is copper.

## How It is Done in Massachusetts.

The negotiations preliminary to the purchase of the electric lighting plant in Chicopee, Mass., by the city form an interesting commentary on the relations of municipalities and electric light companies under the existing law in that state. The commissioners appointed by the Supreme Court on April 23d to set a value upon the plant of the Chicopee Electric Light company have now reported that the plant is worth $27,000. The date of transfer to the city was set for October 1st. The board consisted of ex-Gov. W. E. Russell of Cambridge, James Renfrew of Adams and Theodore C. Bates of North Brookfield. They report at some length regarding the hearing that was given. The principal section of the report is in substance that the building owned and used by the company as an electric light station and the foundation and piers for its electric and steam plant being on land neither owned nor occupied under written lease by the company and not being fitted for removal, the commissioners find and adjudge that they shall not be sold by the company nor purchased by the city. With the above exception it is adjudged that all other property owned by the company as part of or in connection with its electric light plant, shall be sold by it and purchased by the city. The property shall be sold, conveyed and delivered on October 1, 1895, free and clear of all liens, mortgages or other incumbrances. The price paid for all the property shall be $27,000. The property includes all the machinery, etc , of the electric plant, including three Thomson-Houston dynamos, one 50 horse power and one 100 horse power Fitchburg engine, about 35 miles of wire, 119 lamps and over 400 poles. The board sends in its bill for $1,000 for services.

This decision is the outcome of a long controversy between the city and the Dwight company as to the price the former should pay the latter for the plant. The city hired an expert to appraise its value, and he found it to be worth about $18,000, putting a good price, as he said, on everything. This estimate did not include a consideration of the earning capacity or franchise. This the company asked $10,000 for in its bill of $39,000. The commissioners based their estimate, it is said, on the present earning capacity of the plant, while one of the strongest arguments of the city was that the law expressly stated that nothing should be charged for the earning capacity. When an endeavor was made in the first place by the city and the company to come to a settlement without going to law, the company is said to have offered to sell out for $30,000, which would have included the building. Taking out the value of this as $3,000, leaves the exact sum which the city will now have to pay, in addition to the expenses of the hearing, which will amount to over $1,000. Thus the city has lost money by having a hearing.

## Intelligence Demanded in Motormen.

A St. Louis street railway president is credited with these observations: "The general introduction of electricity as a motive power has brought the officers and men of the street roads into closer relation than that they sustained under the old system. The primary cause of this is that it takes a higher order of intelligence to manage a trolley than it does to drive a mule. We have regular schools of instruction now which the men must attend, and this has brought the best of them forward. Ability is quickly detected by the questions asked and the interest taken, and wherever ability is found it is marked for promotion. One result of the school of instruction is that it is steadily reducing the percentage of accidents, and we expect to get this average below the old average on horse car lines. Under the regime of the trolley drink has been absolutely prohibited among employes, and the well-remembered mule whacker, whose capacity for whisky was only exceeded by his versatility in profanity, is of the past. He has been weeded out. It is an indisputable fact that a far better class apply for the position of motorman and conductor than were in the habit of seeking employment as driver or conductor. It is a sort of scientific job now, and not a few fare collectors have by dint of study and observation become pretty well informed electric cars."

## American Street Railway Association.

Next month's convention of the American Street Railway association at Montreal (October 15th, 16th, 17th and 18th) is exciting the attention of street railway men. Despite the care necessary to be exercised by American exhibitors of street railway appliances in complying with the exacting customs requirements of the Canadian government, the gathering promises to be useful and successful in all respects. In St. Louis, judging by a recent article in the *Globe-Democrat*, the coming convention is held to be one of considerably more importance than usual. This article seems to have been inspired by some well informed street railway man, and although it hints at sweeping changes in the organization that are a long way from being accomplished, it makes interesting reading. It is herewith quoted entire:

Considerable speculation is being indulged in by the street railway men of this and other cities concerning the proposed action of the fourteenth annual meeting of the American Street Railway association, which is shortly to be held at Montreal. It was given out some time ago that the scope of the organization is to be enlarged and its character somewhat changed. At the last annual meeting formal steps were taken to bring about the desired change. The executive committee was instructed to elaborate plans. This, it is understood, has been done. The committee has not given out what kind of a report it is going to make. However, among some of the propositions to be presented is the establishing of a central bureau of information, which shall be charged with the duty of answering all questions propounded by members on problems affecting their interests. Questions of operating methods, of patents, of legislation, of franchises, interpretation of law, of insurance, of credits, of contracts, etc., etc. The bureau is to be in charge of men well versed in law, patents, insurance and the like. To run a bureau of this kind, the promoters say, will require a great deal of money, that can only be obtained by subscription and by putting up of the dues. Opinion is divided as to the value of the bureau, in relation to its great cost to maintain. The large companies are, it is said, in favor of the scheme, and will insist on i s establishment, while the small companies will object thereto for the reason of the large yearly assessment they will be called upon to pay. The annual dues at present are $25, when, under the new arrangements, the dues, it is expected, will be at least ten times that amount. This and other equally radical changes contemplated is what has started the talk and the discussion in railway circles. Another change that will be made is the holding of more executive sessions, and that, hereafter, the proceedings, aside from the reading and discussion of papers, will be secret. Heretofore the annual gatherings have been regarded more as a pleasure outing than a business assembly. The thoughtful ones are beginning to see that more unity and a great deal more action is needed on account of the magnitude of the interests at stake and the complications that are on the increase. There are many troubles and difficulties arising during the course of the year that bother many roads in different parts of the country. In other words, many roads are afflicted with the same annoyances at the same time. If all the troubles were referred to the bureau, much worry and expense would be avoided. This is the illustration given by the friends of the bureau. They say that the proposition for its establishment will be carried by a large majority, and that half of the benefits to be derived therefrom have not been told, and can only be known by those on the inside. They further state that, once started, its merits will be highly appreciated by all and voted a grand affair and acknowledged that it fills a long felt want.

The association is composed of the officers and the electrical and mechanical experts of the leading railway companies of this country and Canada, and wields considerable influence. There are nearly 1,000 operating companies in existence, with a total of 13,000 miles of track and a capitalization aggregating something like $1,200,000,000. The statisticans figure out that these properties earn from $125,000,000 to $140,000,000 gross per annum. All the companies are not members of the association, nor one-half, but those who are in it represent about three-fourths of the money invested in street railways. Small roads owning a comparatively few cars and a score or two of mules can not deprive much benefit from an organization of this kind. This is the reason why all have not joined the association. There are some few large roads who fail to see the beauties of being banded together for mutual benefit, or do not seem to be in a hurry about entering into the brotherhood. St. Louis furnishes one of the indifferent companies. All the St. Louis companies are members, except the St. Louis & Suburban Railway company. The St. Louis contingent is always a large one at the conventions, and the officials proceedings show that its members have something to say. Many of them serve on important committees, which duties they faithfully perform. At the last meeting held at Atlanta, Ga., there was a warm contest among the members for the next convention city. St. Louis did not ask for it, but could have obtained the honor with little effort. It was the impression of many of the members at the time that St. Louis will get the next one. The fourth annual meeting, in 1884, was held in this city. Julius S. Walsh was the president.

Beside the national association there are many state organizations. These are subordinate to the national, but wholly independent and unconnected. The state organization is supposed to be a protective body, whose chief aim is to see that no adverse or pernicious local or state laws are enacted. It is claimed that a great many benefits are derived in the union of the street car companies of a state. The cost is insignificant, the dues being small and the special assessments few and of modest amounts. Missouri has no state organization in name as yet, although the St. Louis, Kansas City and St. Joseph companies have a quasi under-

standing, and have worked together on at least one, if not more, occasions. Last winter a bill was introduced at Jefferson City to reduce the fare to three cents between certain hours of the day. Representatives of the companies from the three named cities visited the capital and soon convinced the solons that the measure, if passed, would cripple the business and discommode the public. A fender bill was introduced, and that, too, failed of passage. Without doubt, the knocking out of the proposed legislation prevented the introduction of more absurd bills for the government of street railway companies.

Chas. T. Yerkes, the Chicago multi millionaire railway king, who is also largely interested in several traction companies in other cities, has taken considerable stock in the Siemens & Halske Electric company of America, located in Chicago. That company has lately bought the mammoth manufacturing plant of the defunct Grant Locomotive Works at that point, and it is now given out that the Siemens & Halske company will manufacture mostly electric generators, motors, cars and electric locomotives. Mr. Yerkes has been quoted as saying that all the electrical machinery his Chicago roads, and the other roads belonging to the traction companies of which he is a stockholder, will require hereafter will be made by that company. Some of the knowing ones assert that Mr. Yerkes is making an attempt to get all the large roads of the country to take stock in the new enterprise. The aim of the projectors, it is claimed, is to convert it into a national co-operative affair. Those who pretend to be posted hint that something startling will happen at the meeting of the street railway men at Montreal. They say that the association will then and there decide to manufacture its own machinery, cars, and do away with the middlemen altogether as regards supplies, which means the saving of millions of dollars annually.

## Effect of Threatened Competition on Telephone Stock.

[From the Nashville, Tenn., *Banner*.]

The telephone mystery is the all-absorbing topic of the town to-day. It is in fact a mystery because nobody seems to have any more definite knowledge to-day of the make-up of the new company than he had yesterday. The agitation has had a depressing effect on the Cumberland Telephone stock, and to-day it was not to be sold at any price.

This fact has led some observers to believe that the subscription business is simply a movement to bear the market for telephone stock, but there appears no well-grounded reason for this opinion. The better opinion and the more prevalent belief was that the new enterprise was substantially backed and meant business. Merchants and men in all branches of business talked in favor of the scheme and readily signed the subscription blank.

It was rumored that the strong legislative influence which the old company had used on former occasions was transferred to the new company, and color was given to this by the fact that some of the large stockholders in the Cumberland were among those who wanted to sell to-day.

A significant fact in connection with this telephone movement is that efforts are being made to secure subscribers in various towns contiguous to Nashville. It is understood that solicitors are at work in Murfreesboro and Lebanon. There are already new lines operating in McMinnville and Clarksville.

A gentleman who has been spending the summer at Hygeia said to-day that a telephone line was being built toward Nashville passing that point. The gentleman in charge of the construction has very strong papers from New York parties very much like those submitted here some weeks ago. The work is being done quietly, but it is supposed that the line is intended to connect the new Clarksville system with the proposed new lines here.

If the movement in all of these towns comes from the same source, it will not take long to construct a complete system of associated lines. This phase of the matter gives strength to the belief that it is a big syndicate that is behind the movement.

The solicitors, who started out so well yesterday, were at work again to-day, and they report encouraging reception of their proposition. A number of merchants and others who are stockholders in the old company have signed the contract of the new.

## A Schenectady Report.

From the *Schenectady Star*.]

The General Electric company remains true to its first love and will not abandon it. The company is to remain in Schenectady; Kruesi avenue is to be closed, and the General Electric company, in accordance with the terms of the agreement, will immediately begin the erection of new buildings. The whole matter has been practically settled and the official announcement to that effect will be made this week.

"This is a glorious thing for Schenectady," said one of the prime movers in the matter, "and it means much more for the city than most people imagine. The General Electric company to-day employs about 4,000 hands in its Schenectady plant. With the accumulated forces from Lynn and Harrison this number will be doubled. That means that the present pay roll, which the *Star* has correctly placed at an average of $45,000 per week, will be doubled. It also means that in less than five years' time the population of Schenectady will be increased 10,000.

"The General Electric company has plans all ready for new buildings and the work of erecting a few of these will be commenced at once. They will be completed in less than two months, and by the first of October there will be at least 1,000 more hands employed at the works than at the present time."

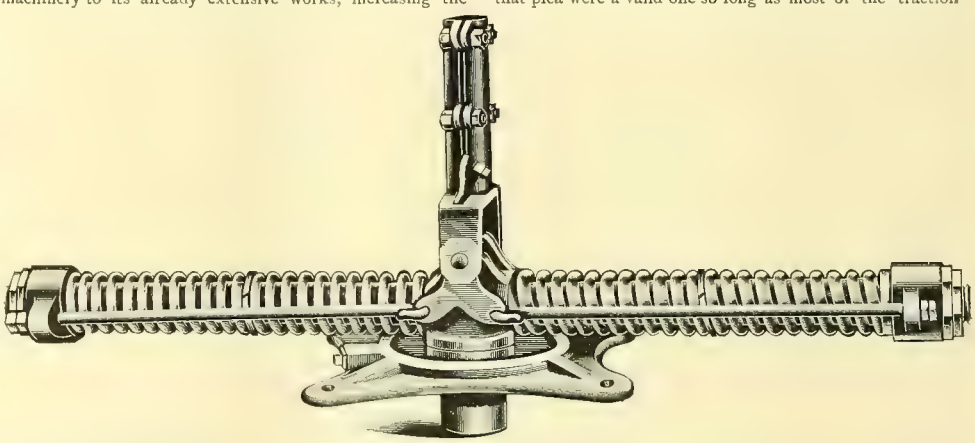
The *New York Herald* clings to the belief that some day, a few decades hence, the elevated railroad managers will discover that their cheerless, ill-lighted and overcrowded cars can be run by electricity.

## Nuttall Improved Trolley.

It is interesting to note the history of the development and perfection of the trolley for electric railway cars. Trolleys were first made with chains and adjusted with bolts. However, these chains constantly gave way, and side rods were introduced. It was then discovered that jam nuts at the end of the spring pipe would be an improvement in connection with nuts on side rods. The next improvement was the introduction of springs, these springs being made 18 inches long. On account of the extreme length of these springs it was found almost impossible to temper them. To obviate this difficulty the R. D. Nuttall company of Allegheny, Pa., now makes two springs, each nine inches long, which take the place of the one 18 inch spring formerly used.

Almost every electric railroad brings up new features in connection with the use of the trolley, the conditions to be met by one electric street railway company differing from that of another. Sometimes the car is compelled to pass in under a bridge and the trolley is bent down to within two or three inches of the car roof, while again the pole may stand at a right angle with its base. To meet all these various conditions the management of the Nuttall company has been enabled, through its extensive experience and mechanical skill, to manufacture a standard improved trolley, which is claimed to be of the best construction, most economical in repair parts, equally serviceable beneath high or low structures, durable and highly efficient.

The Nuttall trolley is being used by some of the largest street railway companies in the country. It has made an enviable record. The R. D. Nuttall company manufactures street railway supplies generally. The demand for trolleys, gears, pinions, etc., has been so great that this company has been obliged, in order to meet this demand, to add new machinery to its already extensive works, increasing the capacity about 50 per cent., the output of trolleys alone being in the neighborhood of 500 per month.



NUTTALL IMPROVED TROLLEY.

## Proposed Cable to Hawaii.

[From the New York *Sun*.]

The people of Honolulu are interested in a new proposal that has just been made to their government for connecting the islands by telegraphic wire with the American mainland.

It is the project of Col. C. S. Spalding, a prominent sugar planter, who adds to this scheme that of connecting the islands by cable with each other, estimating the entire cost, apparently, at about $4,000,000. In return he asks a subsidy of $50,000 a year for twenty years, which will entitle the government to send its own messages free of charge. He demands the exclusive privilege of landing cables from the American coast, subject to any rights possessed by the United States; and concessions of land for stations and routes, with freedom from taxes, are also parts of the proposal.

As to the propriety of these terms Hawaii must be the judge. The main point just now is that this plan is sound on the question of the American terminus, which is to be at San Francisco or its neighborhood, and not at Vancouver or any other point in British Columbia. The Fifty-third Congress had before it a proposition, communicated through Mr. Cleveland, for renouncing certain treaty rights of this country, in order that the British government or a British company might be able to lay a British wire from a British port to islands which we expect soon to annex to the United States. Naturally, no encouragement was given by Congress to this proposal, for it has all along been evident that sooner or later a cable should be built from our shores to the Hawaiian Islands.

Indeed, several years ago the Senate, by a large majority, passed a bill to furnish a very heavy subsidy to a proposed Honolulu cable, heavy enough, as it seemed, to cover nearly the entire cost of it. The House did not concur in that measure, but it agreed with the Senate in having soundings for such a cable made at the government's expense, and the Albatross and Thetis surveyed three such routes. That was done while as yet there was no talk of annexation, the throne still existing. Last February, also, the Senate voted $500,000 for laying a cable which the United States government was to control.

It is admitted that while the Spalding scheme asks aid from Hawaii, it proposes also to apply for a subsidy from Congress. Whether it will succeed in this purpose we cannot say. Possibly the best policy for any such project would be to handle the big end first, by securing the approbation of the American Congress. Sooner or later the cable will be laid, and perhaps even at the coming session we shall know whether Congress will make the work a government undertaking, or will aid its accomplishment through private enterprise.

## Lower Street Car Fares.

[From the *Chicago Tribune*.]

It was stated in the *Tribune* yesterday that the street car fares in Toronto are four cents, while only 3 cents is charged during certain hours of the day, besides which the city has a share in the gross receipts of the street car lines and other valuable privileges. The fact is the company has agreed to pay the city $800 per annum for each mile of single track and a liberal share in the gross receipts, the payment increasing from 8 per cent. on the first $1,000,000 to 20 per cent. on all receipts above $3,000,000, while tickets are supplied to school children at the rate of 10 for 25 cents, so that, irrespective of age, the scholars may ride at what would be half fare in this city.

The Toronto schedule is none too liberal for adoption in Chicago. Single fares might be allowed to remain at 5 cents, but not less than six "rides" should be sold on a ticket for 25 cents and 30 rides for a dollar. There are people in Chicago old enough to remember the times when tickets good for six rides were sold at 25 cents each and the companies made large profits, though the paper money paid for the ticket was worth but 65 to 75 cents on the dollar. They can recollect that the depreciation of the paper currency during the war was the only reason adduced by the companies for raising the cost of transportation to 5 cents for each journey, irrespective of shortness of distance. It was on that plea the fare was increased.

We have been for nearly 17 years past on the gold basis, but the companies have made no motion toward putting the fares back to former figures. Increase of distance, due to city expansion, has been cited as an offset to the disappearance of the currency premium on gold. But if that plea were a valid one so long as most of the traction was done by horses, it is not so now that the cable has greatly reduced the expense and the trolley wire has cut it in two. The public ought to have a share in the benefit of the reduction, and that benefit should be all the more liberal in the price charged for transportation over the lines, as the companies are not paying the municipality except in a way that is beggarly as compared with the payments made into the city treasury at Toronto and some other places.

As the companies in Chicago pay the city practically nothing for their monopoly franchises, the only way in which the citizens can derive any real benefit is by a substantial reduction of fares. Five cents for riding a few blocks on a cable, "L" or electric car on the street surface is altogether too much when the company has the free use of the streets for its tracks and a monopoly of the right of way over them. It is not improbable that public sentiment will force the companies to recognize the justice of this position if a way cannot be found to reach them by legislation. There can be no doubt that the widespread use of the bicycle in going to and returning from the scenes of their daily avocations by persons residing in the city and its suburbs has been fostered by the feeling that the street car companies have charged too much for the service and did not provide sufficient accommodation for those who wished to patronize them at the two extremes of the business day. Their exaction of full fare for half room has been in very unpleasant contrast with the Toronto plan of selling 25 cent tickets good for eight rides between 5:30 and 8 in the morning and 5 and 6:30 in the evening, and allowing children to go to and from school at a rate which amounts to but 5 cents for the double journey.

Will the companies reduce their fares voluntarily or "wait till they are asked" in tones which they cannot misunderstand and dare not disregard? They have the opportunity to make the concession gracefully. Will they do it?

## Improvements in Electric Lighting.

A recent writer asserts that much of the present outdoor lighting is condemned as crude and unscientific. The street arc lamps dazzle and strain the eye, throw sharp shadows and waste light. The next improvement will probably be the use of lower candle power lamps, placed at shorter intervals, and having reflecting hoods. The bottom half of the globes will be semi-opaque and possibly tinted a deep orange color. This would neutralize the painful glare of the arc lamp and give the streets the effect of being illu-

minated with Chinese lanterns. In domestic lighting shades having prismatic corrugations on their surfaces are coming into vogue. They give a good diffusion of light, with but little absorption. An authority on decorative lighting says that although many new ideas have sprung up in the distribution of masses of light in interiors, none have yet superseded in beauty and effectiveness the system of putting lamps out of sight and lighting the room entirely by diffused and possibly colored light. This will probably be the method of illuminating churches in the future. In churches where it has already been adopted the effect is described as so infinitely restful and appropriate that in comparison the ordinary methods of church lighting seem garish and barbarous.

## CORRESPONDENCE.

### New York Notes.

NEW YORK, August 31.—There is much talk of conduit trolley roads in this city. It is said that the Metropolitan Traction company has resolved to extend the underground system now in operation in Lenox avenue, recently described in the WESTERN ELECTRICIAN, to all the lines owned by the company in New York. The formal action was taken at the last meeting of the board of directors, it is claimed. In relation to the line now building in Twenty-third street, President Vreeland of the Metropolitan Street Railway company said: "We are putting in this section of the line now on account of an agreement with some of the large property holders there. That portion of the line lying between Fifth and Sixth avenues will be finished next month. It is not our purpose to build farther at once, but we hope to have a crosstown line finished some time next year. Horsecars are too slow for such a busy street as Twenty-third street, and our motive power will probably be electricity. The line now in process of construction is similar to the Lexington avenue line, adapted for use either by the cable or underground trolley. It will not be necessary to erect a separate power house for the Twenty-third street line, as we have plenty of room in the Lexington avenue power house to furnish the crosstown line with power. We hope for great things from the underground trolley. The line now in operation on Lenox avenue has demonstrated the practicability of the device. The invention is the property of the General Electric company, and, as it is still new, not much is being said about it. There is plenty of room for the introduction of a cable if necessary, making it very convenient in case of accident." Another scheme for a conduit trolley road is in Eighth avenue, from Canal street to the Harlem river. Ex-State Senator George W. Plunkitt, who is named as the originator, makes the following statement: "I believe that an underground trolley will be put in Eighth avenue in place of the horsecar line, to run from Canal street to the Harlem river. Some directors of the Eighth avenue line are satisfied with having a smaller dividend rather than a temporary break to secure a larger. But the plan is not hostile to the Eighth avenue line. On the contrary, a change must be made for the line's sake. Competition from the cable and elevated roads is lessening its value. The system which we intend using, if we are successful in obtaining the trolley, will be the underground after the Budapest manner, but with great improvements."

Col. E. A. Stevens, president of the Hoboken Railroad, Warehouse & Steam Connecting Railway company, has made application to the Hoboken Common Council for permission to build an electrical railway along the river front, to afford direct connection between the steamship docks and the railroads. The proposed line is to run through Hudson and Fourth streets and Willow avenue. In his communication to the Council Col. Stevens calls attention to "the necessity of affording to shippers and steamship companies such facilities as will not only retain the present seaport business already located along the river front, but also attract such further business as the city by its natural geographical conformation and position is entitled to."

Another case of partial blindness from the flash of a trolley car is reported. Mrs. Alexis Chapius of Paterson was crossing Washington avenue one night this week when a trolley car passed in front of her. As the car passed a bright flame shot from under the wheels as they came in contact with some rock on the tracks. The light was very brilliant, and enveloped the car for a moment. Mrs. Chapius felt a shock and put her hands to her eyes to protect them from the light. When she removed them she found she could not see. She was blind, and had to be assisted to her home. By medical aid her sight has been partially restored, but the attending physician thinks that she will never recover her full sight.

It is asserted that Fred Bliss, the motorman who some days ago ran over and killed Ethel Denham in front of her home in Brooklyn, had been working at the time of the accident nearly 36 hours, with only one hour's sleep. His landlady makes this statement: "Fred should never have worked on Friday. He had been up all night with his car and did not get home till nearly two o'clock. He was very tired, but I set his alarm for three o'clock. I told him that he must have more than an hour's sleep, but he said he couldn't. I called him at three, but he was so tired that he fell asleep over the breakfast I had prepared for him. Fred came in about half-past two in the afternoon, and I asked what the matter was. He sobbed: 'I'm a murderer. I ran down a little one this morning.' 'Were your eyes shut?' I asked. 'No,' he replied, 'but I had a presentiment this morning that something was going to happen, and it did.'" Another motorman corroborated the story that Bliss had asked to get off and had been told to go to work. He said Bliss could hardly keep his eyes open.

It is stated that the recently formed Gas & Electric Light Manufacturers' association is a trust of the manufacturers of gas and electric light fixtures, but this is denied.

W. F. O.

### Milwaukee, Wis.

MILWAUKEE, August 31.—The sensation of the hour in electrical circles is the sale of the stock of the Milwaukee Arc Light company to the Milwaukee Street Railway company, and the manner in which it was consummated. The Milwaukee Street Railway company, which owns the Badger Illuminating company, acquired the Arc Light property just in time to prevent that company from bidding on the city lighting contract. By the deal the Milwaukee Street Railway company has an absolute monopoly of the electric lighting business of the city as well as of the street railway business. Its purchase of the Arc Light property did something in addition to giving the Milwaukee Street Railway company a clear field in the electric li hting business. It turned foes into the most certain kind of allies. The owners of the Milwaukee Arc Light company received their pay in stock in the Milwaukee Street Railway company, getting it at the rate of 20 cents on the dollar. Thus the politicians and ex-aldermen who were interested in the Milwaukee Arc Light company, and who were the most determined opponents that the Milwaukee Street Railway company had for a considerable period, are bound by their own interests to fight the battles of the street railway company, and all are combined against Lawrence McGann and the other street railway men of Chicago who are trying to get a franchise in the city. The representatives of Mr. McGann in this city realize the significance of the deal, and are more or less downcast in consequence. The influence of the new combination will be felt in the Common Council. John J. Kempf, who was one of the owners of the Milwaukee Arc Light plant, is authority for the statement that the business will be conducted by a new corporation, the Milwaukee Electric Light & Street Railway company. The Milwaukee Street Railway company, it should be remembered, is in the hands of receivers, and it would not do for it to appear too openly in the deal, as it is supposed to be insolvent. There never was a bankrupt, however, that showed more life or enterprise. It seems to have three or four times the business energy now that it is in the hands of receivers than it had before it went into court with its little plea of insolvency. It has been projecting new lines of late at a rate which has been most astonishing, and now it caps the climax by gobbling a small but somewhat dangerous competitor. The price paid for the Milwaukee Arc Light plant is said to have been in the neighborhood of $100,000. The plant cost about $137,000 some five or six years ago, and it has about 1,700 incandescent lamps and 180 arc lamps in use. Its capital stock was $100,000. Its plant is located on Commerce street. Its business was purely commercial and confined for the most part to the Second and Sixth wards, in the neighborhood of its plant. The original owner of the plant was the Milwaukee Lighting & Power company. The business was not prosperous and the plant was sold at the instance of the creditors. The purchasers organized the Milwaukee Arc Light company.

The receivers of the Milwaukee Street Railway company were the only bidders for the city lighting contract. On a five-year contract the receivers proposed to furnish lights at $109 a lamp a year if underground circuits were used, and for $92 a lamp a year where overhead wires were permitted. They offered to furnish lamps at $105 a year for underground circuits and $89 a year for overhead circuits if the city made a contract for 10 years at these prices. The company paid no attention to the call for bids for electric lights for one year and for two years. This course indicated that the company was afraid of the municipal lighting project. There is a prospect of the plans being carried out in a year or two, and the company apparently is trying to force the city into a long contract. The city now pays $110 a lamp a year. As the law stands, all electric lighting wires must be underground, and if the Common Council wished to take advantage of the lower bids for overhead service the ordinance now in force would have to be amended. The members of the Board of Public Works consider that it would be very unwise to accept either of the offers made by the company, and there is a prospect that the city will resume the use of gas for lighting the streets. Gas, of course, would not be used any longer than would be necessary to erect a municipal lighting plant. Alderman Thuering of the Fifteenth ward says that he will introduce a resolution for the use of gas street lamps. It seems to be settled that the city will not enter into a contract for so long a period as five years. The company, on the other hand, asserts that it could not enter into a contract for one or two years, with the extensions that would be ordered, for less than from $200 to $250 a lamp. The matter is in the hands of the Common Council.

The Common Council committee on railroads has held two meetings to consider the McGann street railway ordinance, and as yet has not arrived at any decision. At the first meeting an adjournment was taken to permit the appearance of Receiver Henry C. Payne before the committee in opposition to the franchise, although it is said that it was just by chance that the applicants for the franchise were enabled to be present at the first meeting. They were not notified of the meeting, they say, and would not have known of it but for the newspapers. They were reinforced by many citizens of the different wards through which they propose to build lines. Alderman Williams said that he would not vote in favor of granting the franchise unless a fare of four cents was specified. Mr. Somers pointed out the fact that the ordinance provides for the sale of six tickets for 25 cents. Mr. McGann detailed the history of the project and assured the council that he meant business. A canvass of the council shows that neither company is sure to win the fight. The Milwaukee Street Railway company is very influential and it may prevent the new company from getting a franchise. The demand for a new line, on the other hand, seems to be very strong, and there are many who think that the aldermen will not dare to disregard it. The McGann company wants to build across Folsom place bridge, and Alderman Grootemaat says he is opposed to anything of the kind unless the company strengthens the bridge, which, it is estimated, would cost about $30,000. He is also of the opinion that the franchise of the new company, instead of running for 50 years, should be made to expire in 1924, when the franchises of the Milwaukee Street Railway company also expire. The Sixth ward aldermen object to the road's being built on Fifth street. That thoroughfare, they say, has been improved at considerable expense, and the improvements would be partly ruined by the building of street railway tracks. They suggest that Fourth street would be just as good a route for the company and more acceptable to them. The First ward aldermen do not want to have the road built along Warren avenue. Some of the Seventeenth ward people object to the running of cars on Logan avenue, and Clement avenue is proposed instead. Some of the aldermen insist upon the new company's giving a larger bond than it proposes to give as a guarantee of good faith. The bond that it offers is in the sum of $25,000. Some of the aldermen want a bond of $100,000 and others demand a bond of $250,000. There are 36 aldermen, and it is said that 15 of them will vote for the ordinance as it stands, nine will oppose it, nine want amendments made to it, and three are so non-committal that their position cannot even be guessed. The new company asks for the privilege of using the Milwaukee Street Railway company's tracks for a distance of a block on lower Fourth street. It is provided in the older companys' franchise that the council shall have the right to allow other companies to use its tracks on that street, but the company, nevertheless, will make a strong fight against anything of the kind. Mass meetings have been held in various wards in the city for the purpose of creating public sentiment in favor of the McGann company, and they have succeeded in doing so. In one instance a meeting of residents on First avenue was called to protest against the building of the new line on that street. The McGann people, however, captured the meeting, which adopted resolutions in favor of the franchise. In one or two cases the other fellows captured the McGann meetings and caused resolutions to be adopted against the granting of a franchise to the new company. Alderman George Thuering has gone to Chicago to look into the standing of Messrs. McGann, C. C. Bonney, C. L Bonney and their associates in the McGann company which is operating in that city. Alderman Thuering says that if they have a good system in Chicago and will do the right thing by Milwaukee, there is no reason why they should not get a franchise here.

The South Milwaukee village board has again postponed action on the Milwaukee Street Railway company's ordinance. The board suspects that Cudahy is trying to deprive South Milwaukee of a street car line, and fears that if it grants the most desirable route into the village to the Milwaukee company it may have the effect of keeping the McGann company out without giving the village a branch of the Milwaukee line. The two villages are very jealous of each other anyhow, and now they are keeping a very close eye on each other.

There is considerable talk of a suit to set aside the Milwaukee Street Railway company receivership. Dr. Herman C. Block recently obtained a judgment in the Superior Court for $5,790.10, the result of a suit for damages for being run into by an electric car, and it is proposed that he and other judgment creditors combine to set aside the receivership, on the ground that it was brought about for the purpose in part of avoiding the payment of this and similar judgments.

One of the causes of the Appleton Edison Electric company going into the hands of a receiver is said to be the trouble about the Fox river water power. A. L. Smith, who was the president of the company, is the receiver. His bond is in the sum of $10,000. The receivership was asked for by the New York Security & Trust company, which holds a $75,000 mortgage on the company's plant. The officers of the electric company joined in the application for the appointment of a receiver, acknowledging that the company was unable to pay its debts. The indebtedness of the company, according to President Smith, is $111,930. The assets consist of the electric lighting plant and the street railway plant. The road at Appleton is the oldest electric street railway in the state. In an affidavit Mr. Smith says that the value of the assets is about equal to the amount of the liabilities, but that the income therefrom has been very much reduced of late. A competing electric light company has been organized, it is stated, and the recent action of the government in shutting off the supply of water for power purposes has reduced the lighting capacity of the plant and in the minds of many people has greatly injured the value of the franchises. The city of Appleton has put the company to heavy expense during the past year in raising and lowering the tracks. The aldermen, moreover, passed a resolution to annul the street railway franchise when the shutting off of water caused the cars to stop running.

The Fox river water power, which figures in the Appleton Electric company receivership, is causing a great deal of trouble. The United States government has spent many large fortunes in improving the historic stream for navigation, and the present rule is that when the water is below a certain point the use of it for manufacturing purposes shall be stopped, the idea being to save all the water possible, when the river is low, for the boats. The electric light companies in the Fox river valley, as well as many large manufacturing plants, depend upon the river for power, and without exception they have been compelled to close this summer. The electric street car service at Appleton was discontinued some time ago, but it was thought that the electric light company would be able to continue to draw water. In fact, it is understood that Gen. Doe, the assistant secretary of war, tried to help the people of Appleton in this particular, but finally positive orders from the United States engineers came to the effect that the water must be shut off for electric light purposes.

There will be no electric street car line between Milwaukee and Waukesha this year. In fact, the company which has been formed to build the line and operate the old Milwaukee and Wauwatosa motor line will not even transform the present road into an electric system this year. The company claims that the survey of the road to Waukesha has been completed and that the right of way has been secured. It was intended to have the whole line in operation by the middle of next month, when the state fair will be held, but as it is the road will be in the same condition that it was in last year. The dummy engine will continue to haul people to the state fair grounds. President J. W. Bingham states that subscriptions to the capital stock of the new company are being made as fast as could be expected. The capital stock is $1,000,000, and he says that more than $500,000 has already been subscribed.

The Milwaukee & Whitefish Bay railroad will be equipped with electricity early next year. The line will be three miles in length, extending from the corner of Folsom place and Glen avenue to the village of Whitefish Bay. Through electric cars will be run between the village and the business district of the city every 15 or 20 minutes when the improvement is made. General Manager Wyman has strongly recommended the improvement to the Milwaukee Street Railway company and estimates of the cost have been made. The Milwaukee company has also virtually decided to extend the Vliet street line to West Park, to extend the Twelfth street line and to build a line to Layton Park next year. The company is hard at work upon its Clybourn street line. In order to build the line an enormous ravine about four blocks across had to be filled up, and the company has about completed the big job. This line is the one that will be extended to the Soldiers' Home and Calvary cemetery. It will follow Clybourn street down into the Menominee valley almost to the St. Paul railroad tracks.

President McQuarrie of the Milwaukee branch of the Amalgamated Association of Street Railway Employes, who was employed at the street railway shops, has been discharged, and there is a strong feeling among the men in consequence. General Manager Wyman says he did not know that McQuarrie was president of the union, but McQuarrie says that he has conferred with the officers of the company in his capacity of president, and that they must have known that he was at the head of the union. A committee of the men will confer with Receiver Payne when he returns. McQuarrie, meanwhile, is working for the union at a salary. C.

## PERSONAL.

Frank B. Rae of Chicago has been retained by the aldermen of Rockford, Ill., to prepare plans and specifications for the proposed electric lighting plant in that city.

H. Ward Leonard was married to Carolyn M. Good at noon on August 24th, at the National Hotel, Geneva, Switzerland. Mr. and Mrs. Leonard are expected home about October 1st.

F. E. Mandeville, for several years the western manager of the C & C Electric company, has resigned that position to assume charge of the gas engine business of the J. I. Case T. M. company of Racine, Wis., in the South. Mr. Mandeville departed for Atlanta, his new headquarters, last week. He will make a display at the exposition and also open a permanent office. Mr. Mandeville has great confidence in the future of the gas engine, and as he is an unusually bright and energetic salesman, he will undoubtedly make a great success of the business. He bears the good wishes of many Chicago friends.

## ELECTRIC LIGHTING.

An English journalist refers to the chimney of the new Islington electric station as "the big chimney which is to carry off the fumes of generation."

A franchise granted in 1887 to the Aurora, Ill., Edison Light company has been made use of by the men composing the Excelsior Light & Power company of that place. The plant is to be in operation within 90 days.

The contract for the establishment of an electric light plant in Bardstown, Ky., has been awarded to the General Electric company of Cincinnati, the firm offering to put in the plant complete for $7,194. Lights will be turned on about the middle of October.

The *Journal* of Topeka, Kas., thinks that there is a gigantic scheme on foot by an eastern syndicate to buy all the private electrical plants in the city and consolidate them under one management. The same syndicate, it is reported, intends to purchase the street car lines and to build the lower dam, by means of which it will operate both the lights and the cars by water power.

The City Council of Chester, Pa., has passed the electric light ordinance over the mayor's veto. This ordinance provides for a new contract with a new company, with a saving of $16,300 to the city over former contracts. The contract is for five years. It was the most important ordinance before the Chester council in many years, and it has been blocked at every stage of progress by injunction and other methods, but is now a law.

C. N. Parker has offered to purchase the electric lighting plant of Brainerd, Minn., for $60,000, principally in bonds of the proposed Brainerd Public Works company. He agrees to furnish to the city arc lights at a price not exceeding $8 per month and incandescent lights for not more than 25 cents per month. Mr. Parker also offers to defray the entire expense of a special election to enable the citizens to vote upon the question, as required by law.

A press dispatch from Oelwein, Iowa, says: "This city has made an offer to the Independence Electric Light company of a $10,000 bonus in city warrants, bearing 6 per cent. interest, if it will move its plant to this city. The plant was some of the property left by Williams, the famous horseman, at Independence, when he went to the wall. The plant has been furnishing light to the merchants of Independence, and the city wanted it to light the streets, but the price demanded was considered exorbitant, and the city has now put in a plant of its own. The poles are set and the wires strung, and will be ready for business in a few days. This will throw the Independence plant out of a job, and it is conceded that the offer made by our city will be accepted."

## ELECTRIC RAILWAYS.

Frank Silliman, Jr., the new general manager of the Scranton, Pa., Traction company, has taken charge of the Scranton street railway system.

George W. Kendrick of Apollo, Pa., requests the WESTERN ELECTRICIAN to announce the fact that he would like information and estimates for the construction and equipment of three miles of street railway.

Albany and Schoharie, N. Y., are to be connected by an electric railroad, which will be built for both passenger and freight service. The freight tonnage is expected to be made up of moulding sand, bluestone flagging, hops and farm produce.

It is claimed that the Kansas City & Independence Rapid Transit company has no valid franchise for the lines which it operates in Independence, Mo., and is in fact a trespasser. A case was taken to the Supreme Court a few years ago from Independence arising out of a suit for damages for the grading of a street occupied by a street railway. When the court passed on the case it made the declaration that the street railway never had a franchise because cities of the fourth class in the state of Missouri had no power to grant a franchise to any street railway. Independence was a city of the fourth class at that time, and it was a city of the fourth class when it attempted to grant a franchise to the Kansas City, Independence & Park Railway company, which transferred its rights to the present company. The franchise which the road claims to-day is the one granted when the city was a city of the fourth class, and thus had no right to grant a street railway franchise of any kind.

All the property of the Syracuse, N. Y., Consolidated Street Railway company was sold recently to Frederick F. Strauss of New York, secretary of the bondholders' committee, for $865,000. The amount of the bonded indebtedness of the Consolidated company is $1,250,000, and the stock of the company was of the same amount. With reference to the failure of the Syracuse Street Railroad company to buy the Consolidated, as it was generally expected it would, a representative of the company said to a reporter: "All there is about it is that the system has been sold for much more than it is worth. We were in the field to pay any reasonable figure, which under the circumstances would be a price greater than the property is really worth, for, of course, the Consolidated ought to be more valuable to us than to anyone else. It would be better for us and better for the people if there were one system in the city, but we could not afford to go beyond a certain figure."

In the financial columns of the *Chicago Tribune*, it is announced that "A number of important electric lines will be started on the West Side this week. The Ogden avenue line is now in operation and several other lines which are expected to largely increase the traffic will be running in a few days. Business on the Western avenue line is showing an increase of 40 per cent. One of the most remarkable increases is shown on North State street. The increased travel there is sufficient to pay all the operating expenses of the line, and the net earnings are now as large as the gross earnings were before the electric cars were started." The subject of the relative cost of propulsion under the various systems is attracting much attention. One paper says: "A street railway official in this city is quoted as saying that animal power costs about 65 per cent. of the operating expenses of the lines, while the trolley will diminish the cost of motive power to 35 or 40 per cent. of the operating expenses. The difference is an enormous gain. The difference between the cost of operating by cable and by trolley must be much less than that, but seems to be sufficiently great to cause a decided preference for the trolley in new construction."

The report of the board of directors of the Liverpool Overhead Railway company says: In presenting the half-yearly statement of capital and revenue accounts to June 30, 1895, the directors have to report that the gross revenue receipts amount to £28,143 3s. 1d., and the working expenses to £18,653 18s. 1d. The number of passengers carried since the opening of the railway has been as follows Half-year ending December 31, 1893, 2,475,639; half-year ending June 30, 1894, 2,861,437; half-year ending December 31, 1894, 3,641,379; half-year ending June 30, 1895, 3,460,060. These figures show a continued and satisfactory increase in the traffic. The contracts for the southern extension have been let, and the works will be commenced without delay. In order to meet the necessary expenditure the directors have decided to offer to the shareholders at par, on application, the unissued portion of the ordinary capital. The amount available for dividend is £8,076 17s. 5d. Out of this balance the directors recommend the declaration of dividends at the following rates (less income tax) payable on and after August 17th, viz., 5 per cent. per annum on preference shares, £2,529 0s. 9d.; 2¼ per cent. per annum on ordinary shares, £4,244 17s. 9d., leaving a balance of £1,302 18s. 11d. to be carried forward to next half-year.

The Cicero & Proviso Electric Railroad company now has twenty miles of track, reaching the various Chicago suburbs in the neighborhood of Cicero, Proviso and Oak Park. This company opened the first electric railroad in Chicago and its suburbs. The company was organized in 1889 by some twenty people in Cicero and Oak Park. A line from Oak Park to West Fortieth street, connecting with the Madison street cable, was completed and the first train run February 26, 1891. The Ogden street railroad now has in operation only one mile of track, that from Madison street south to Twelfth street on West Forty-eighth street. The franchises which have been granted this company are extensive in character and cover many streets in the towns of Cicero, Proviso, La Vergne, Clyde and Harlem. The Cicero and Proviso and the Ogden are both controlled by the Yerkes interest. An arrangement has been made with the Metropolitan Electric whereby there will be an interchange of transfers which will be used on all lines. The lines connect the towns of Moreland, Linden Park, Austin, Ridgeland, Oak Park, River Forest, Maywood, Melrose Park and Harlem, the Concordia, Waldheim and Forest Home cemeteries, and the villages of La Vergne, Berwyn, Clyde and Hawthorne. The transfers will be good in Chicago as far as West Fortieth street and west to the east line of Riverside, north to North avenue, and south to Thirty-ninth street. For one fare a person may go from any one of the suburban towns to any other named, even though he is required to use the three systems to make the trip.

## TELEPHONE.

A press dispatch dated Trempealeau, Wis., August 6th, says: A number of well-known citizens will meet this week to see what can be done about organizing the Interstate Telephone company. The object is to span the Mississippi to the Minnesota side with a wire that will connect with the lines of the Northwestern Telephone company now being constructed. The distance to be covered is not over a mile, and there are strong reasons to believe that the connection will soon be made. The line would be a great convenience and include Trempealeau in the circuit covered by the long-distance telephone lines to New York and St. Paul.

A new telephone company has been incorporated with headquarters in Columbia, S. C., by W. Y. Abrahams,

W. B. Lowrance, F. D. Kendall, A. R. Stewart, R. G. Johnston, T. J. Harper and J. B. Friday. The company is to start out with a capital stock of $5,000 and it is intended to have all subscribers interested as stockholders, and with that view the shares are to be fixed at $25. The subscription list is already quite large, and Mr. Abrahams expects to get about 2,000 subscribers to the new system, which is to be installed for $25 a year in stores and $18 in residences. The Bell company charges $40 for store service.

The Lansing telephone exchange has been established, articles of incorporation were filed, and the election of its officers held. The first stockholders' meeting was attended by some of the soundest and best business men of the city. The following is the list of stockholders, all of whom were present at the first meeting: Jacob Stahl, John Herrmann, G. H. Ziegler, G. A. Cockburn, C. A. Clement, Walter Pratt, W. J. Beal, Hardy Bros., W. A. Fraser, Ed. Hamblin and D. A. Reynolds. Jacob Stahl was elected president of the new company and D. A. Reynolds manager. The capital stock of the company is $30,000, of which $20,000 is paid in. Mr. Stahl's standing and capacity as a business man justifies the selection and Mr. Reynolds' activity in promoting the company merits the position given him.

The Ticonderoga Telephone company, Ticonderoga, N. Y., has awarded a contract to the Western Telephone Construction company, Chicago, for apparatus to equip a telephone exchange for that city. The company has also arranged for toll lines connecting towns along Lake George and Lake Champlain. The Elgin City Railway company, Elgin, Ill., has closed a contract with the Western Telephone Construction company to furnish apparatus for a private telephone system. The same company has been awarded the contract by the Altoona Phœnix Telephone company, to furnish complete apparatus for a telephone exchange at Altoona, Pa. Wapokonetka, Ohio, will have a new telephone exchange within a short time. The apparatus will be furnished by the Western Telephone Construction company, as will also that for the Lansing Telephone Exchange company of Lansing, Mich., which is building a 400 telephone capacity exchange, complete. Barnesville, Ohio, has fallen in line with Newark, Mt. Vernon and Chillicothe, and has contracted with the Western Telephone Construction company for complete apparatus for a telephone exchange.

## POWER TRANSMISSION.

It is said that a company is being formed to utilize the power of the Potomac at Great Falls for electrical transmission to Washington. Those who are behind the project are reticent as to their plans, but it appears that the Potomac Power company will be closely related to the Capital Traction company.

The Power Development company of San Francisco, which has been incorporated with a fully paid in capital of $500,000, proposes to develop the water power existing at the mouth of the Kern river canyon, about 14 miles northeast of Bakersfield, Cal., which has a minimum flow of water of 500 cubic feet per second. It will be used under a head of 190 feet, which will furnish 10,000 horse power at the least. The power will be transmitted by lectricity to the towns of Bakersfield and Kern under a pressure of 10,000 volts. The power will be used for the purposes of electric lighting and general power work and the running of an electric railway system from the Southern Pacific railroad depot at Kern through Bakersfield and to a proposed new park beyond the town, which will be used for amusement purposes. A large portion of the power will also be used for pumping water from underground strata. A plentiful supply of water exists there at a depth of from 10 to 20 feet beneath the surface. By this means large quantities of water, which otherwise would be lost by seepage, can be diverted into canals for the purpose of irrigation. Another corporation, allied with the Power Development company, will operate the lighting, electric railway and power systems, and the new gas works. It is proposed to supply power to consumers at a price equivalent to what it would be if coal could be bought for $6 per ton. The present price of coal in Bakersfield is $13 per ton.

The Boston Duck company of Bondsville, Mass., the mills of which are now operated partly by water and partly by steam, will hereafter use electric motors. From the water the company is able to derive about 600 horse power over the present steam plant, consisting of two 250 horse power engines; one being run condensing and furnishing power alone, the other non-condensing and being used partly for power and partly to furnish exhaust steam to the dye houses. The dye houses, however, require the exhaust steam from about only 100 horse power. Thus if the power were not required in the mill to help out the water wheels, the condensing engine could be shut down entirely and the other engine could be run at about half its capacity only. Three thousand feet below the mill this company owns another water privilege on a difference in level of 22 feet. This was developed some years ago, and the company even went to the expense of building a foundation for a mill before it decided to give up the project. Since that time electricity has come upon the scene and the water power has now become of considerable value. Wheels are to be set up in the unused mill and the 500 horse power is to be transmitted back to the mills at present in operation at Bondsville. This will enable the company to dispense almost entirely with the present steam plant. The General Electric company has undertaken to install the necessary electrical apparatus for this plant. It will consist of one three-phase 400 kilowatt 900 volt generator and one synchronous motor of similar size, which will develop 485 horse power on its pulley. The loss in the line has been calculated at about 3 per cent. only. In estimating the economy effected by the introduction of electricity, the Boston Duck company has announced that it will not count the cost of the development of the second water power made in 1880 when calculating the operating expenses of the complete plant, as the money put out for the hydraulic improvements cannot be recovered and will not therefore be counted in as part of the present development.

## MISCELLANEOUS.

By direction of the executive committee the date for holding the annual convention of the National Association of Manufacturers at Chicago has been changed to November 19, 1895.

The employes of the Chicago Edison company enjoyed a picnic at Electric Park on August 24th. The day was set apart as "electricians' day," and the committee in charge consisted of H. E. Niesz, R. H. Fermier, H. Frosch, E. Lakeman, C. Harding, A. O'Malley and P. J. Smith.

At the Atlanta meeting of the American Water Works association Chas. A. Hague read a paper on electrical pumping machinery. His main argument was that the convenience and controllability of electrical power, together with its simplicity of application to the work of pumping, commends it very strongly for use in isolated places, such as high-service systems in public water supply, wherein a comparatively small percentage of the total water supplied by the initial plant is needed for dwellings situated upon levels too high to be accommodated by the general pressure.

The City Council of Indianapolis has passed a sweeping ordinance repealing all franchises to telegraph and telephone lines within the business district of the city, including territory a mile square, and ordering that all telephone and telegraph wires be removed within a reasonable time. This is a determined stand by the council looking to the placing of all wires underground. The companies must go to the Board of Public Works for their contracts hereafter, the council placing all authority with the board. The Phœnix Telephone company has agreed to place its wires underground, and the repealing ordinance was passed to place the old company on an equal footing with the new organization. It is believed there will be a hard fight by the telegraph companies before they will put their wires underground.

The Electrical Bureau and Fire Department of Philadelphia are entitled to the credit of having devised, manufactured and put into practical operation on the fire boat Edwin S. Stuart a very ingenious system of electric light signals, which is described as follows: On the boat 32 candle power incandescent lamps have been placed on the port and starboard sides, on the bow, and for the high stern lights. These are very important lights, and to insure perfect knowledge as to their condition when they should be in service a novel feature has been introduced in the shape of a tell-tale lamp placed directly in front of the pilot. Should either of these lamps be extinguished from any cause, or should the pilot fail to turn the switch to light them, an electric lamp is automatically lighted directly in front of the pilot, immediately calling his attention to the fact that these important lamps are not lit. The bow light is ingeniously enclosed in a cylindrical-formed case with glass front, with a slide at the back that can be turned aside, giving access to the lamps.

Among the most recent and novel applications of wire, perhaps none has greater interest to the mechanical world than that presented by the wire flywheel lately erected at the Mannesmann Tube company's works, Germany. Heavy flywheels, driven at high volocities, obviously present dangers of breaking asunder from the great centrifugal force developed. The wheel at the factory mentioned consists of a cast-iron hub or boss, to which two steel-plate disks or cheeks about 20 feet in diameter are bolted. The peripheral space between the disks is filled in with some 70 tons of No. 5 steel wire, completely wound round the hub, and the tensile resistance thus obtained is far superior to any casting. This huge flywheel is driven at the good speed of 240 revolutions per minute, or a peripheral volocity of about 2.8 miles per minute (250 feet per second, approximately) which is nearly three times the average speed of any express train in the world. The length of wire upon such a constructed flywheel would be about 250 miles. The use of paper is also regarded with favor as a face for large flywheels, the tensile strength of paper being enormous, and it is quite possible that some of the new big flywheels will be built up with a paper rim.

## TRADE NEWS.

It is said that the St. Louis Car company contemplates the establishment of an erecting shop in Philadelphia. By shipping the cars in sections from St. Louis and putting them together in Philadelphia heavy freight charges could be saved on eastern orders.

W. Clay Leonard, Jr., H. L. Hickey, C. V. Webber, M. L. Leonard and J. H. Hopkins have organized the American Electric Construction & Supply company at Parkersburg, W. Va., with a capital stock of $100,000. The company will establish a supply house and do all kinds of construction work. It is in the field for electrical goods.

The Beacon Lamp company of Boston met with flattering success with the 11,000 lamps used in the Knights Templar decorations. J. R. Masury, electrician of B. F. Keith's new theater, reported that he used three makes of lamps in his Knights Templar decorations. Two-thirds of them were of the Beacon manufacture, and in a four-hour test they lost but one Beacon lamp, and 40 and 200 of the other makes respectively. The conditions under which they were used were very trying, owing to the intense heat due to close grouping of the lamps. The Beacon Lamp company is justly proud of this result.

The Phosphor-Bronze Smelting company, No. 2200 Washington avenue, Philadelphia, has purchased the processes and exclusive rights for the manufacture of Delta metal in the United States, and is now prepared to furnish the same in castings, stampings, forgings, bolts, rods, etc., of equal quality to those made in Europe. Delta metal has established an enviable reputation throughout England and the Continent for exceptionally high properties; it possesses strength equal to mild steel, with great rigidity, toughness and resistance to corrosion, and is especially adapted for use in propellers, blades and shafts, heavy and light gearing, drop forgings and stampings, valve stems, screws, bolts and nuts, and all purposes requiring exceptional strength at moderate cost.

The Ball & Wood company, New York, reports that never in the history of its business has it had so many orders on its books as at present. This condition of affairs has compelled it to make not only a large addition to its works in building a new boiler-house and rearranging its steam plant, but also in the purchase of more large tools. Recent orders include engines for Milwaukee, Wis.; Terre Haute, Ind.; McGregor, Iowa; Helena, Mont.; Denver, Colo.; Colorado Springs, Colo.; New Orleans, La.; Altoona, Pa.; Wilkesbarre, Pa., Flatbush, N. Y., beside a large number for the new buildings now going up in New York city. Both from its Chicago and New York offices this company reports some stiffening in prices, and altogether it is confident that the improvement of business will continue.

As a result of the visit of H. J. Medbery, the president of the Fiberite company, to the different agencies, the selling department has been placed on a better basis than ever before. The large quantities of Medbery overhead material sold during the last season has warranted the company in making more attractive prices, while the quality of the goods is kept up to the high standard set by the company years ago. With the largest factory in the world devoted to the manufacture of electric railway supplies, with unexcelled facilities for purchasing raw material, and with agencies manned by well-known, active and reliable sales agents, the Medbery is certain to retain a leading place in the electrical supply field. On account of the many inquiries received, the Chicago agent, the Mason Electric Equipment company, has just issued an illustrated circular showing the different devices manufactured by the company.

The Miller-Knoblock company of South Bend, Ind., is prepared to furnish anything desired in the way of a track sprinkler for street railways. It builds tanks or tank cars complete, giving the tank any capacity desired, or can furnish, if preferred, sprinkling wagons to be drawn by horses, that can be used off or on the track as wanted. The company's facilities for building large as well as small tanks is unexcelled. It uses the best tank stock obtainable, and gives its customers the choice of Washington red cedar, Louisiana cypress, white pine or steel. The company fits the cars with patented brass telescopic, variable heads, and applies them at one end or both ends of the tank as preferred. The operator controls the amount of water being thrown on the ground, using the lever. When the car starts up the operator pulls the lever back a notch in the ratchet index, sprinkling lightly, and as the speed of the car accelerates, he can open the head wider, adapting the flow of water to the speed of the car, so that the ground will be uniformly wetted irrespective of the rate of speed.

A. Chisholm & Co. of Bay City, Mich., manufacturers of Peerless commutator compound, report that the demand for their product is steadily increasing. There is hardly a large city in the country where the Peerless commutator compound has not many friends, and it is found that if a dynamo tender once becomes a user he always remains one. One point of special excellence, and one which commends this compound to every practical electrician, is the absence of heating. Almost everything used on the commutator has a tendency to cause heating, but this is not the case when the Peerless compound is used. All agents report great success in making sales and say that consumers speak in the highest terms of praise of this compound. The New England agents are W. B. Southgate & Co., 146 Franklin street, Boston, while the Bradford Belting company of Cincinnati, O., looks after the middle states territory. In Texas the agent is W. T. M. Mottram of Dallas, and at Detroit, Mich., the Commercial Electric Engineering company represents Chisholm & Co., while the Pacific coast agents are Reger & Atwater of San Francisco.

## BUSINESS.

The Partridge Carbon company, Sandusky, Ohio, reports that the sale of the Partridge carbon is increasing every month, and that it is coming into favor with all large and small roads.

The Bradford Belting company of Chicago has added to its business an electrical supply department, and promises reasonable prices, good goods and fair treatment. It carries a large line of electric light, street railway, telephone, telegraph and fire alarm supplies.

The Electric Appliance company is making a special effort on telephone line material, and is prepared to make exceptionally low prices on copper and iron line wire, pony glass insulators, pins, brackets and cross-arms, making shipment in all cases promptly from Chicago stock.

The Ransome Subway company of Chicago is exploiting a system of monolithic subways, by which electric wires can be laid in a cement pipe or ditch formed directly in the ground for sewerage or other purposes. The system is claimed to be the strongest, best and cheapest system of pipe construction known.

The prospects of good business are nowhere more encouraging than in the vicinity of Boston. Among the firms which have been obliged to add to their machinery and labor to keep apace with orders is the Sampson Cordage company, which is well known for the production of arc light and trolley cord. This concern reports that the outlook was never better for fall trade.

W. B. Southgate & Co. of Boston, Mass., report they are exceedingly busy for this time of the year, as the fall trade has begun much earlier than usual. They have recently issued a new catalogue, for which there is a large demand. This concern has been rushed in filling orders for slate material for switchboards, switch bases, etc. The demand for the Tilden watchman's electric time recorder is also showing a rapid increase.

"Coal Handling for Steam Generation" is ably described in a pamphlet issued by the C. W. Hunt company of 45 Broadway, New York. This company's excellent appara-

tus is well known, and it has equipped some of the largest steam plants in the country. It makes this claim: "We have made this class of machinery for more than 20 years, and it has been used not only in all parts of this country, but in most foreign countries, and during this time no workman has ever been killed or injured by the breaking of anything that we have furnished. The same painstaking care that has given us this exemption from accident in the past is still continued."

"Color your own lamps," says the Webster Chemical company of 400 Sibley street, St. Paul, Minn., "by using Crystal chemical coloring—a solution designed and compounded for coloring incandescent lamps." The process consists merely of an immersion of the lamp in a bath of the solution, withdrawing immediately, and drying upon exposure to the air, producing a brilliant and durable transparency. The cost is about one cent per lamp more than clear lamps, and it is claimed that lamps thus treated will last the full life of the lamp, retaining their brilliancy permanently. They will not fade. The coloring will keep indefinitely, provided it is kept in the bottle well corked.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued August 27, 1895.*

545,042. Hysteresis Compensator. Bruno Abdank-Abakanowicz, St. Maur, France. Application filed March 17, 1893.

The invention illustrated comprises a method of correcting or neutralizing the effect of hysteresis in electro-magnetic apparatus, which consists in employing in such apparatus a main and an auxiliary magnetic circuit and neutralizing the effect of the residual magnetism of the first circuit by that of the second.

545,069. Electric Annunciator. George J. Galbraith, Boston, Mass. Application filed April 27, 1895.

A solenoid annunciator drop composed of a proper support is employed, together with a solenoid, a sliding armature core for the solenoid, a swinging multi-armed drop-plate adapted to be alternately retained and released by the sliding armature, and a swinging lever adapted to both limit the movement of the sliding armature and to alternately retain and release the drop-plate, according to the movements of the sliding armature.

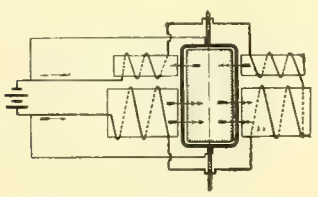
545,070. Underground Electric Railway. David F. Graham, Springfield, O., and William P. Allen, Chicago, Ill. Application filed June 21, 1894.

A conductor is supported in a conduit, and a device adapted to make direct contact with it consists essentially of a main supporting plate, metallic shoes or plates insulated from the supporting plate, bearing supports in contact with the plates or shoes, and contacting springs, each supported in slotted openings in the bearing supports and curved outwardly at the center

545,073. Trolley. Julius L. Hanson, Omaha, Neb. Application filed June 4, 1895.

The chief features of the invention are a suitable base plate and post, a hub revolubly held upon the post, the hub being provided with an extending arm and ears, a trolley pole movably secured to the ears, an adjustable sleeve upon the extending arm, and adjustable sleeves upon the trolley pole, an extending bar movably secured to the arm sleeve, a bar movably secured to the pole sleeve, a spring bar movably secured to the arm sleeve, continuing in a ring and terminating in a stem, the stem being movably secured to the bar extending from the pole sleeve, a spring bar movably secured to the pole sleeve, and continuing in a ring and ending in a stem, the stem being movably secured to the bar extending from the bracket sleeve.

545,091. Electric Gas Lighting Apparatus. James W. Palmer, Nashua, N. H. Application filed January 9, 1895.



NO. 545,042.

The first claim is for the combination of a gas burner pillar, provided with a fixed insulating electrode, an oscillating gas cock, and a plate thereto affixed, and a three-arm vibrating piece, one arm loosely pivoted to the plate, another arm carrying the wiping electrode, and the third arm connected with an actuating rod or wire.

545,111. Means for Synchronizing Electric Motors. Elihu Thomson and Edwin W. Rice, Jr., Swampscott, Mass. Application filed March 8, 1893.

This arrangement of a power system includes a continuous current generator, a circuit extended therefrom, a plurality of motors having field coils and armatures with continuous current windings, adapted to receive the generated current, and multiphase connections taken from the windings, in combination with a circuit controller, whereby the speed of both armatures may be varied simultaneously and independent of the multiphase apparatus.

545,149. Electro-magnetic Tool. Charles F. Carpenter, Louisville, Ky. Application filed August 20, 1894.

In an electro-magnetic tool the combination is claimed of a fixed electro-magnet, having its extension on the outer side of the motor coil, a solenoid or motor coil, and electro-magnet with axial hammer rod, having a reciprocating motion therein, and counter-balancing or equipoising springs.

545,151. Insulated Support for Trolley Lines. Frank X. Cicott, New York, N. Y., and Warren J. Belcher and Frederic C. Billings, Hartford, Conn. Application filed April 22, 1895.

An insulator stud is adapted to support a trolley line carrier; a bell-shaped protector is adapted to encircle the stud, having a portion of its outer surface beveled; a yoke is provided with means for connection with a guy wire, and adapted to fit said beveled surface, and be clamped thereon; means for clamping the yoke on the protector, and means for clamping the protector on the insulator stud.

545,158. Electric Railway. John C. Henry, Westfield, N. J. Application filed April 30, 1895.

A three-wire system of electrical distribution is employed, in which there is the combination with the main leads and the neutral conductor, of two self-regulating dynamos of predetermined but unlike electromotive force.

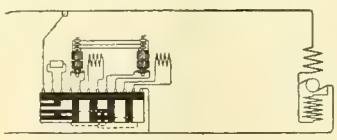
545,187. Trolley Line Clamp. Warren J. Belcher, Hartford, Conn. Application filed April 11, 1895.

Claim 1: In a clamp of the class specified, the combination with an upper and a lower clamping member, the upper clamping member comprising a receiving sleeve and a clamping jaw, and having an opening intermediate of the lower end of said sleeve and the jaw, and the lower clamping member comprising a clamping jaw, adapted to extend around the clamping jaw of the upper member, and having a longitudinally divided sleeve, the adjoining edges thereof meeting within the opening of the upper member, and having the sleeve thereof projecting into the receiving sleeve when the members are assembled, and means for expanding said divided sleeve within the receiving sleeve, and holding said members assembled.

545,191. Telephone Holder and Cut-out. Arthur F. Boardman, Somerville, Mass. Application filed January 2, 1894.

This is a telephone switch, in which there are a receiver, a clamp therefor, comprising a trough and a spring, adapted to grasp and hold the receiver, telephone and call circuits, a spindle operated by inserting the receiver into and withdrawing it from the clamp to open or close the circuits.

545,204. Conduit Electric Railway. Charles H. Johnson, San Jose, Cal. Application filed February 23, 1894.



NO. 545,111.

A trolley for conduit systems, comprising the divided pipe, having its sections insulated from each other, the outer section having a squared outer end, the box-shaped insulating covering surrounding the squared end, and the trolley wheel carrier having a socket clamped upon the insulating covering.

545,208. Underground Electric Railway. Emma E. Moore, Chicago, Ill. Application filed November 16, 1894.

An underground electric railway conduit section is described. It is U-shaped in cross-section and provided with separate conduits located in the two vertical side walls of the section, and each having its upper portion contracted and provided with a slot for the passage of a trolley pole.

545,253. Combined Telephone Receiver Support and Switch. George F. Shaver, Yonkers, N. Y. Application filed December 6, 1894.

The second claim reads: The combination of a T-shaped circuit-changing switch curved up at its outer end, circuit terminals, pivot, spring, post and ring.

545,282. Means for Indicating Coincidence of Phase of Two Alternating or Polyphase Current Machines. Johannes H. F. Görges, Berlin, Germany. Application filed April 4, 1894.

Two alternating or multiphase current machines are each provided with a similarly located auxiliary coil. There are also a potential indicator, a switch, by means of which the current generated in each coil may be separately caused to pass through the potential indicator, a current indicator and a switch, by means of which the currents from the two coils may be caused to pass in opposite directions through the current indicator.

545,291. Fare Register. Stephen C. Houghton, San Francisco, Cal. Application filed September 10, 1894.

In this register are employed a magnet and armature, a lever connected to the armature, a gong, a bell striker and a pivoted lock, having projections and a weight, the lock being controlled by the armature lever.

545,296. Electric Conduit. Charles J. Kintner, New York, N. Y. Application filed March 16, 1893.

NO. 545,149.

Means are provided for forcing air through the conduits, and additional means are located near electrical translating devices for regulating the flow of air at points near the translating devices, whereby improved insulation is effected in the conduits.

545,327. Electric Target. Milton T. Weston, Kenton, O. Application filed December 8, 1894.

The target has a movable bull's-eye, and the circuit-closer is actuated from the bull's-eye, having two contact points. Other features are an electric circuit, including an alarm, the circuit closer and one contact point, a second electric circuit, including an electro-magnet, the circuit closer and the other contact point, a hanger supported by the magnet, and means for short-circuiting the circuit closer.

545,328. Process of and Apparatus for Refining Metals Electrolytically. William H. Wiggin, Worcester, Mass. Application filed May 22, 1894.

In an apparatus for refining copper and like metals by electrolysis provision is made for a tank for the electrolyte, and a movable yoke to support plates of the impure metal vertically therein, combined with an actuating shaft, and insulated connections between it and the yoke, whereby the latter is moved to constantly agitate the plates in vertical planes in the electrolyte.

545,347. Commutator or Collector Brush. Charles L. Coffin, Detroit, Mich. Application filed February 5, 1895.

The device consists of a strip of sheet metal, comprising a solid non-perforated portion and a perforated portion, having a continuous edge.

545,357. Electric Signaling Device. Webster Gillette, New York, N. Y. Application filed July 5, 1894.

A main circuit and battery, a transmitter battery, and a local battery and circuit, combined with an alarm in the local circuit, a receiver, a transmitter, a contact-maker for switching the main circuit out of action and the local circuit into action, and contact-makers for switching the transmitter battery and the receiver and transmitter into the main circuit.

545,358. Trolley Controller for Electric Railways. Leonidas W. P. Gray and Philip G. Doescher, New Orleans, La. Application filed May 23, 1895.

A trolley controller for an electric car is claimed, consisting of a rope connected to the end of the car and to the trolley pole, and an independent rope traversing the top of the car from end to end, and carried over pulleys at the ends, the rope being detachably connected at one end to the rope on the trolley pole at the rear end of the car and carried through the latter longitudinally, its forward end being secured in reach of the gripman at the forward end of the car.

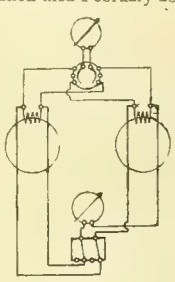
545,359. Electric Arc Lamp. Haydn T. Harrison, London, Eng. Application filed November 19, 1892.

Included in this invention are a frame, having telescopic side bars, a lower cross-bar carrying a carbon holder, pulleys, cords passing over the pulleys and connected with the carbon holders, a magnet core, and a friction block carried by the core between, and adapted to engage the pulleys.

545,369. Clutch Operating Device. William H. Morgan, Alliance, O. Application filed December 6, 1894.

The combination with an electric motor, a driven shaft, and gearing between the armature shaft and the driven shaft, of a clutch on the driven shaft, an armature to be acted upon by the field magnet of the motor, and connections between the clutch and armature are described.

545,390. Secondary Battery. Illius A. Timmis, London, Eng. Application filed February 28, 1895.



NO. 545,282.

An element for these secondary batteries consists of a thin sheet of metal corrugated in parallel uninterrupted continuous lines, and folded or plaited in continuous lines intersecting the corrugations.

545,393. Guard and Guide for Electric Trolleys. John R. Trisler, Westwood, O. Application filed June 1, 1895.

A guide piece for electrical trolleys is adapted to receive the wire or its equivalent between its upright sides, and pivotally supported in front of the trolley and in a position to be normally below the upper part of the latter, from which position it is adapted to rise.

545,402. Telephone and Return Call System. Thomas R. Brimner, Baltimore, Md. Application filed August 16, 1894.

Combined in this system are two batteries, two automatic electric call-bells, a circuit connecting the batteries in opposing polarity normally through the call-bells, and two pole-reversing devices, one at each call-bell, each arranged in the circuit and capable of making two different connections, one a vibrator stroke and the other a single stroke, between a call-bell and the circuit.

545,404. Electrically Operated Mine Car. Henry B. Dierdorff, Columbus, O. Application filed December 24, 1889.

In a mine car the combination is claimed with the main frame, having the side bars, driving wheels and the axles therefor mounted on the side bars of the plate mounted on the side bars, and having motor-supporting standards, a shaft journaled in bearings on the plate, a motor mounted on the standards, gearing connecting the motor and the shaft, and power connections between the shaft and the axles.

545,405. System of Electrical Distribution. Thomas A. Edison, Llewellyn Park, N. J.

A system of electrical distribution is claimed, including a source of electricity of high tension, a circuit extending therefrom, tension-reducing converters in series across the circuit, translation circuits supplied by the converters, and a conductor extending from between the converters to the source of supply.

545,416. Telephone. George F. Shaver, Yonkers, N. Y. Application filed June 8, 1895.

This telephone transmitter consists of electrodes, having faces which are divergent throughout a portion thereof, metallic strips attached to their faces at their most widely separated points, the strips being connected to the line wires, with loose carbon filling the space between the faces of the electrodes.

# Western Electrician.

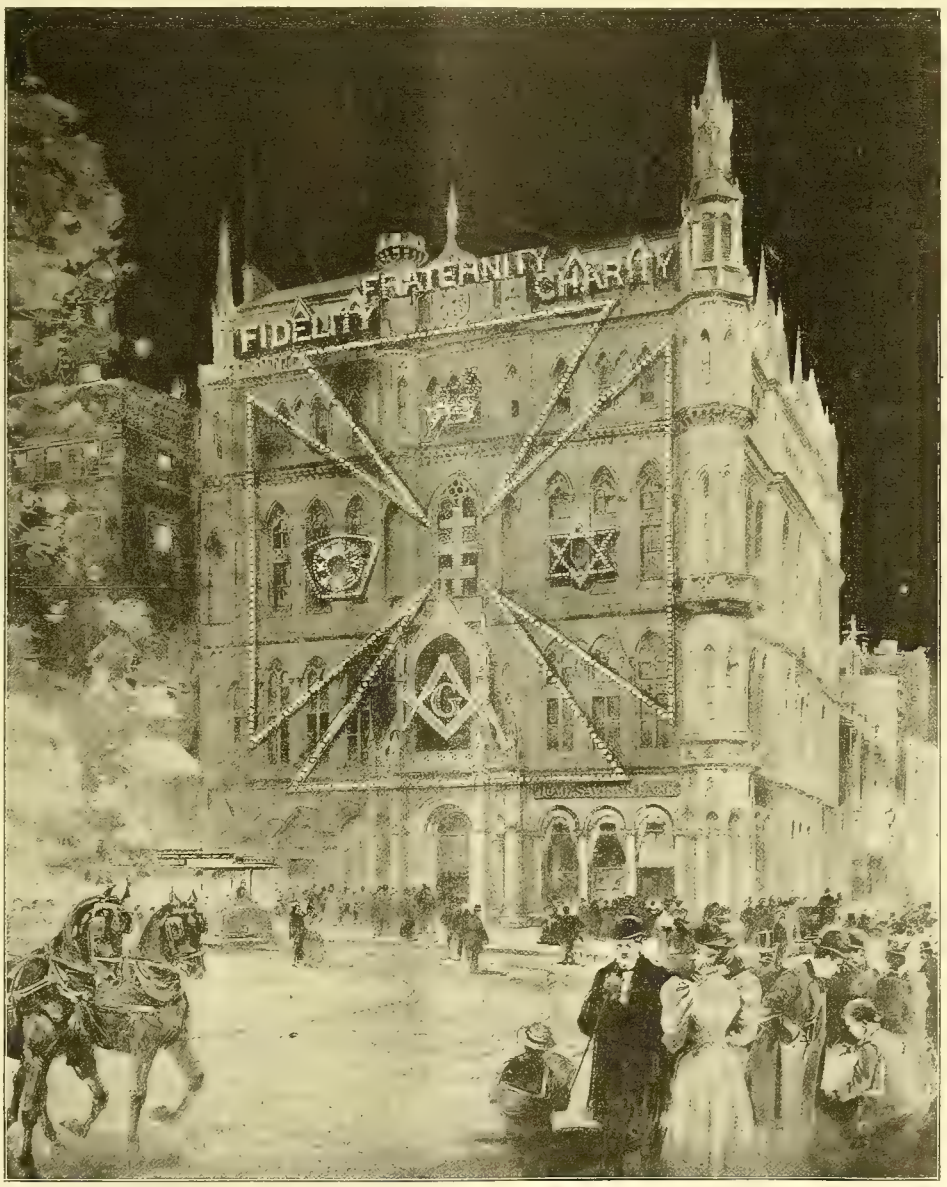
EVERY SATURDAY.

Vol. XVII. CHICAGO, SEPTEMBER 14, 1895. No. 11


## Electrical Decorations at Boston.

Noteworthy among the features which distinguished the 26th triennial conclave of the grand encampment of the Knights Templar of the United States held in Boston was the brilliancy and beauty of the electrical decorations. The town had been accused of being "electrically mad" before, but nothing like the conclave display was ever seen in New England in the way of electrical illuminations.

The illustration shows the lamp decorations of the Masonic Temple, which were brilliant in the extreme. This structure is of granite, and is located on Tremont street, at the corner of Boylston. The basis of the illumination was a mammoth Templar cross, 85 feet square, and 70 feet across the outer edge of each arm. This covered nearly the entire face of the Tremont street side of the temple, and it was outlined in a double row of red and white lights, alternating, in all 513. In the upper division of the cross was the passion cross and crown of the order. This was 15 feet square, and its outlines were developed by means of 124 red and white lights. The space in the center of the big Templar cross was occupied by a Salem cross, 15 by 10 feet, and in outlining this 125 yellow and purple lights were used. The emblem of the consistory, the double triangle, was shown in the right wing of the Templar cross. This consisted of 88 red and frosted lamps and, like the other designs, alternated in colors. In the left wing the Royal Arch chapter was represented by a keystone 10 feet square. Its outline was in red and white, while within the double circle, in the center, also similarly outlined, were the emblematic letters of the degree, "H. T. W. S. S. T. K. S." This design consisted of 136 lamps. The square, compass and letter G of the blue lodge were shown in the tower wing. This was 10 feet square and outlined in 168 blue and white lamps. On the top edge of the building appeared the words "Fidelity, Fraternity, Charity." These letters were four feet high and 29 inches wide, and it required 964 lamps to make them.




ELECTRICAL DECORATIONS AT BOSTON.—VIEW OF MASONIC TEMPLE DURING CONCLAVE OF KNIGHTS TEMPLAR.

On September 7th the magnificent temple, so lately the scene of exceptional brilliancy and display, was badly damaged by fire. The loss is estimated at not less than $100,000. An incendiary origin is suspected.

Probably the most elaborate display by any business firm was made by Houghton & Dutton. The building is located on the corner of Tremont and Beacon streets. On the Beacon street side of the building on the roof edge was the word "Fraternity;" over the clock "Fidelity;" on the Tremont street side "Charity." The letters were four feet high and in alternate colors of red and white. About 1,400 lights were used in this design. On the curve of the building, on the corner, were shown some particularly fine electrical effects. Above the ninth story was the blue lodge design, the square, compass and G. This was 10 feet square and contained 400 lights, the letter was in red and the square and compass in white. Around the clock were 85 red and white lights. Above the seventh floor appeared the Templar cross. This design, 18 feet square, was outlined by three rows of white lights, while within the border were massed red lights, in all 1,902. This was one of the finest attempts at massing color shown in the city. Above the fifth floor appeared the word "Welcome" with letters three feet high, containing 350 red and white lamps, each letter alternating in color. Above the second floor the letters "K. T." were shown, with 300 lights in each letter. The letters were outlined in white and filled with red. On the Beacon street side of the building, between the sixth and seventh floors and resting on the pillars was the Salem cross. This design was 15 by 10 feet and contained 400 lights; the outline was in gold and the body purple. Occupying the same relative position on the Tremont street side a passion cross was displayed in which there were 400 lights. Its color was solid red. In all it is estimated that 6,300 lights were used in the display.

The big daily newspapers of the city, notably the *Globe* and *Herald*, had their buildings decorated with electric designs. The *Globe* building had the design of the blue lodge, the square, compass and letter G, on the front.

At the headquarters of many of the state delegations electric lights were used in the way of decorations.

## Telephones in Drug Stores.

The Chicago Retail Druggists' association is again agitated over the question of telephone service. There are two views on the advisability of furnishing free telephone service in drug stores. One faction thinks that the druggists are imposed upon by the public, and that every drug store telephone accessible to the use of customers should be an automatic long-distance instrument, so that each user would be compelled to pay a minimum charge of 10 cents before he could secure a connection through the exchange. Those holding this view think that the druggists should share in the profit of outside telephonic conversations held in their stores, and that all the instruments should be of this character. The association has appointed a committee to further the proposed change, and the scheme is explained as follows in a recently issued circular:

> In consideration of the justness of allowing the public to pay for its telephone service, and in order to place all holders of public telephones on a common basis, the [telephone] company has also agreed that upon the adoption by our association of the proposed plan it will at once inaugurate the policy of requiring that all public telephones shall be of the automatic kind.
>
> Subscribers are to guarantee $37.50 per quarter within the flat-rate district. Toll in excess of $37.50 and not exceeding $50 per quarter is to be retained by the company. Toll in excess of $50 per quarter is to be divided equally between the subscriber and the company. In mileage districts proportionate amounts, determined by distance, are to be guaranteed and divided as above indicated.

In advocating this plan Thomas W. Wooten, president of the association, said: "The reason for the move is that the free 'phone is such an annoyance. Often people are a great bother and never say 'Thank you' when they finish using the 'phone. We might put in automatic fixtures of our own, but then the clerks would have access to the till, and one customer after another would be allowed free use until the evil would be as bad as before. The telephone company made us a good offer, and I think it is best to accept it. We might collect a dime from each telephone customer, but drug stores are so numerous that the telephone customers would soon go where they didn't have to pay, and with them would go trade. The plan which the committee accepted after considering everything else was proposed by Mr. Bogerman, a South Side druggist. The canvass will be finished soon, and then the association will meet to

take action on the matter. The regular meeting will be the last Tuesday in October, but I think it will require a special meeting.

On the other hand, the opponents of the proposed innovation are satisfied with the present system, as they believe it brings sufficient trade to pay. They are numerous, and believe that the Druggists' association will not adopt the plan. One of them said: "The promoters simply want all the druggists to pay $200 a year for a long-distance 'phone. But I don't think they will do it. The telephone is one of the greatest advertisements the druggist has. If you begin to charge the trade will take a drop very quickly and won't know what has struck it. I make at least $1 a day and think I'm well paid. But it is doubtful if the automatic pay would be as much as that. Customers who pay for telephone will not be likely to buy anything else."

Physicians are generally opposed to the scheme, as they are usually allowed the free use of drug store telephones.

## Mercadier and Anizan's Combined Urban and Long-distance Telephone.

Messrs. Mercadier and Anizan are the inventors of a combination serving the double purpose of long or short distance telephone communication, at will. One portion of the apparatus they call the microphonic, adapted as represented in Figs. 1 and 2. A switch shown in the plan, Fig. 2, is readily moved to accomplish the change, which consists in letting in or short-circuiting the microphone *M*.

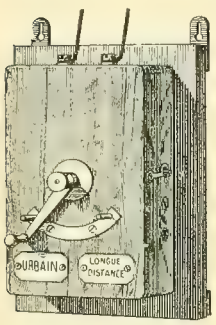



Fig. 1 External view.

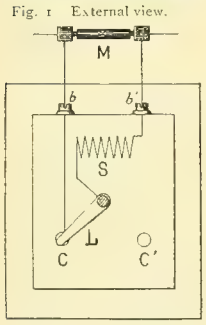



Fig 2. Plan of connections of the adapter.

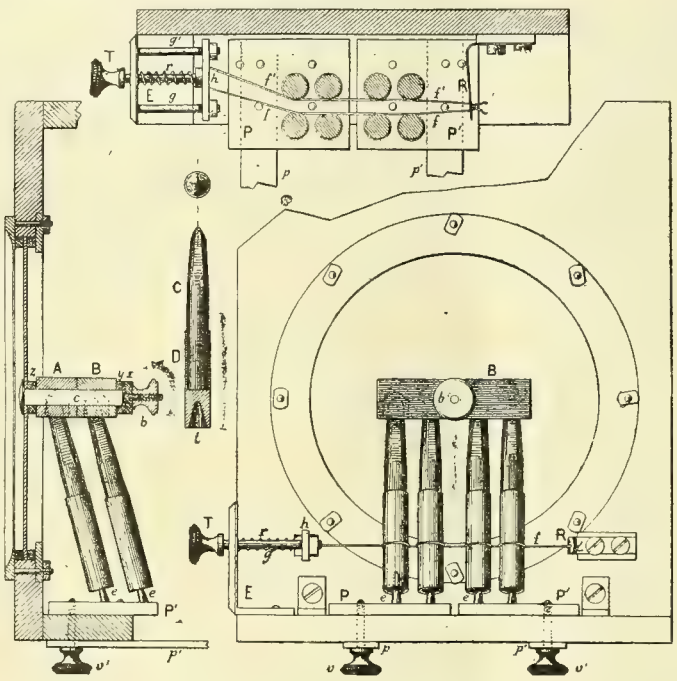



Fig. 3. Sectional views of the transmitter.

MERCADIER AND ANIZAN'S COMBINED URBAN AND LONG-DISTANCE TELEPHONE.

The parts of this apparatus are the contacts *C* and $C^1$, the switch *L*, resistance coil *S*, and the two terminals *b* $b^1$. $C^1$ is connected with one side of *M*.

The box hangs, as is usual, on the wall, and the microphone may be used on short distance conversation, if desired. By testing with and without the adapter it is claimed that though in the first instance the intensity of the sound is diminished, the clear-cut tones of the voice are more intelligible, showing that a certain amount of current crosses the shunt around the microphone, the resistance, of course, being reduced in accordance with the law of derived circuits. On long-distance work the shunt is thrown off.

Two models have been shown by the inventors, one with double carbon prisms, *A B*, pierced for the introduction of eight loose carbons, as at *C D*, as shown in Fig. 3. The prisms *A B* are fixed upon the microphonic diaphragm as shown at *c*, by the screw *b*, and they are designed to make contact through *x y z*. The eight carbons are cylindrical at the base and pyramidal at the upper extremity.

The lower end of each carbon is pierced with a conical hole *t*, and rests upon a metallic pin *e*. Two metallic plates *P* $P^1$, insulated from each other, bear the pins *e e*, etc., which will be alluded to further on.

In the upper part of Fig. 3 a cross-section shows the two plates *P* $P^1$, and the eight carbons, which it will be seen are in two groups of four each in parallel; the two groups are in series through *A B*. The carbons are inclined about 15° to the perpendicular.

An ingenious method is provided for dusting the carbons, which may occasionally accumulate fine particles that interfere with perfect working, or for relieving any one of them which may accidentally stick. A double silk thread, *f f f f*, is carried round each carbon, so that when the button *T* is pulled and released alternately, a steel spring at *R* assists in revolving the carbons, so as either to dust them or change their contact points.

Fig. 4 shows the mechanism of the switch lever, which is centered at *A*, and controlled when released by the coiled spring *i*. The hard rubber insulation *E* carries a pin $g^1$, which serves to open or short-circuit or bridge $r^3$ $r^4$. Near the opposite extreme of the lever, *g* closes on either $r^1$ or $r^2$, according to the position of the fork *C*. In the first instance the line, which ends at *k*, is in connection with the bell; in the second it is in connection with the secondary circuit.

The calling key is a push button of the ordinary form, shown at *D*, Fig. 4. *F* is a second button for reducing the line resistance by cutting out the induction coil while receiving.

The primary coil has 1.5 ohms resistance, the secondary 150 ohms. A bobbin *h*, of 100 ohms, is connected in parallel with the carbons. This is the "microphonic adapter," which smooths, while reducing the volume of sound, and removes much of the cracking and frying attendant on long-distance work, making the tones more readily understood.

The calling arrangement is similar to all ordinary telephone systems and needs no explanation.

The secondary circuit, as has been said, is modified according to the position of *F*. When the spring *a* is separated from the contact *c*, the lever switch being in the receiving position, the current entering at $L^1$ follows the route *K*, *A*, *g*, $r^2$, $t^1$, receiver on the left $t^2$, *s*, $t^3$, receiver on the right $t^4$, $S^2$, $L^2$.

The switch lever being in the position for receiving normally, when the spring *a* touches the contact *c*, the current follows from $L^1$ to *K*, *A*, *g*, $r^3$, $t^1$, left-hand receiver $t^2$, *a*, *c*, $t^3$, right-hand receiver $t^4$, $S^2$, $L^2$.

Whatever the position of *F* the primary circuit is closed by *CM*, *p*, $r^1$, *P*, *M*, $P^1$, $r^3$, $p^1$, *u*, $r^3$, $g^1$, $r^4$, *ZM*, battery, with derivation across *h*, which is mounted on the carbons of the microphone. The microphone is removable by unscrewing *v* $v^1$. The wall and portable models do not vary materially in anything but their form.

The receiver is peculiar, and is shown in Fig 5, where the magnet *A* is fastened to the core of the bobbin *B*, which latter has a resistance of 115 ohms. This bobbin is carefully insulated from the case, a hollow handle containing the magnet. Surrounding this last (shown in section) is a helical spring *R*, with adjusting screw $V^1$ for increasing or decreasing the distance between the magnet and the diaphragm.

For permanently fixing the adjustment the two screws $V^1$ and $V^2$ serve as binding or set screws to each other. The screw $V^3$ serves to hold the handle *E* in place.

The diaphragm has a diameter of 16 millimeters and a thickness of 0.18 millimeter. At *m* is shown the washer ring; a hook ring for hanging up the receiver is not shown in the cut.

The headquarters of the Order of Railway Telegraphers have been removed to Peoria, Ill.

## Telephone News from the Northwest.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

The Baraboo Telephone company of Baraboo, Wis., is an applicant for a franchise. The capital is $3,600.

The Menasha, Wis., city council refused to grant a franchise for telephones to an applicant, and then within a day or two one of the aldermen announced that he had changed his mind and on a motion to reconsider it was granted.

The National Telephone Construction company of Milwaukee is an applicant for a telephone franchise at Kenosha, Wis.

The telephone system at Rochester, Minn., is completed, and the novelty of it not yet being worn off it is used considerably for the amusement of the natives. The press of Chatfield, Minn, suggests building a telephone line to connect with Rochester.

William A. Cottrell of Le Mars, Iowa, has been at Vermillion, S. D., in the interests of a telephone line to be built from Centerville, Iowa, to Sioux City, and beyond that point.

Both the Blue Earth Valley Telephone company of Winnebago City, Minn., and the Western Electric Telephone company of Britt, Iowa, have been canvassing Elmore, Minn., with a view to connecting that place with their systems.

Hon. Walter Butler has made final arrangements at Spring Valley, Minn., to extend his telephone system to that place, and says it will be done in 60 days. He thinks it will be extended to La Crosse this fall and connections made with Preston, Minn.

The Iowa and Minnesota Telephone company has extended its line from Decorah to Cresco, Iowa.

The Northwest Engineering company, which has put in a telephone system at Ortonville, Minn., and Big Stone, S. D., is soliciting among business men of Millbank, Revillo, Wilmot and Twin Brooks, S. D., to extend the line to those places.

It is understood that the Northwestern Telephone Exchange is about to extend its line from St. Cloud, Minn., to Little Falls. A right of way has been secured.

The proposed telephone exchange at Mitchell, S. D., has not received sufficient encouragement. The company had no trouble in getting all the business men of the place to take telephone service, but they were not sufficient to maintain an exchange, and householders were backward, so the project is dropped for the present.

Davenport, Iowa, authorities propose to tax the 5,000 telephone and telegraph poles there 50 cents apiece per year.

The Mutual Telephone company, which secured a franchise in Butte, Mont., several months ago, is soliciting subscribers actively and will put in a system if enough can be secured.

Maurice Auerbach of St. Paul, who is connected with the Standard Telephone company, says he does not know when the company will get to operating in St. Paul. Some obstacles have arisen which will temporarily delay matters, but work will begin as soon as possible.

A telephone line from Litchfield or Willmar, Minn., to Minneapolis is suggested,

The Western Electric Telephone company of Britt, Ia., is working in Preston and Lanesboro, Minn., for subscribers and proposes to go to LaCrosse, Wis., from Preston.

The Iowa Union Telephone company is putting in a new exchange at Decorah, Ia.

The Phoenix National Telephone company of Des Moines, Ia., has been incorporated with $1,000,000 capital stock. The general nature of the business will be constructing, owning, operating and managing telephone exchanges, plants and instruments, and constructing, owning and managing steam and electric railways, etc.

The automatic telephone system has been on trial at Chariton, Ia., for a while, but the sweet-voiced hello girl will be substituted, as the automatic system does not give satisfaction.

The Wisconsin Telephone company was granted a franchise last Saturday at Wausau, Wis. The ordinance could not be published immediately, but this little formality did not deter the telephone company, for it at once went to work setting poles and stringing wires regardless of the city's rights in the matter. Mayor McEachron notified the company to stop, but no attention was paid to the order. The police were therefore ordered to stop the work and the construction superintendent was arrested for violating the city ordinance by digging holes in the street. Then followed a contest between the telephone men and the police. The police started to cut down the poles, and to prevent this, the telephone men climbed them to the top. They came down again, however, when they saw the possibility of a sudden drop. Later Superintendent Gallagher went to the scene armed with a revolver and he was again arrested and disarmed, and the city was on top. The next day the telephone company secured a restraining order preventing the city from destroying or interfering with the property,

pending a hearing for an injunction. The company also sues for $100 damages for interfering with the work of the construction crew and destroying the property the day before.

The new La Crosse Telephone company began operations September 1st. In its address to the public the company offers to guarantee, indemnify and protect patrons against all legal proceedings which are threatened.

The new Citizens' Telephone company of St. Joseph, Mo., is in trouble. Its plant was attached by Henry F. Strong to secure salary due him as secretary. A majority of the stockholders have an application for a receiver pending and will fight the execution.

A new telephone exchange will soon be opened at Madison, Wis.

Lightning has cost the telephone company at Webster City, Ia., over $250, six poles being torn to pieces and many instruments burned out.

The Rocky Mountain Bell Telephone company has absorbed the Great Falls & Lewistown Telephone company.

The Sunset Telephone & Telegraph company is rebuilding the telephone system in Seattle, Wash.

A complete telephone and electric bell system has been put in at the branch prison at Marquette, Mich.

The Rocky Mountain Bell Telephone company is about to rebuild the Butte, Mont., telephone system, replacing the iron wire with copper. Butte is one of the hardest places in the country for telephones, as the sulphur fumes from the smelters consume the iron wires completely in three years.

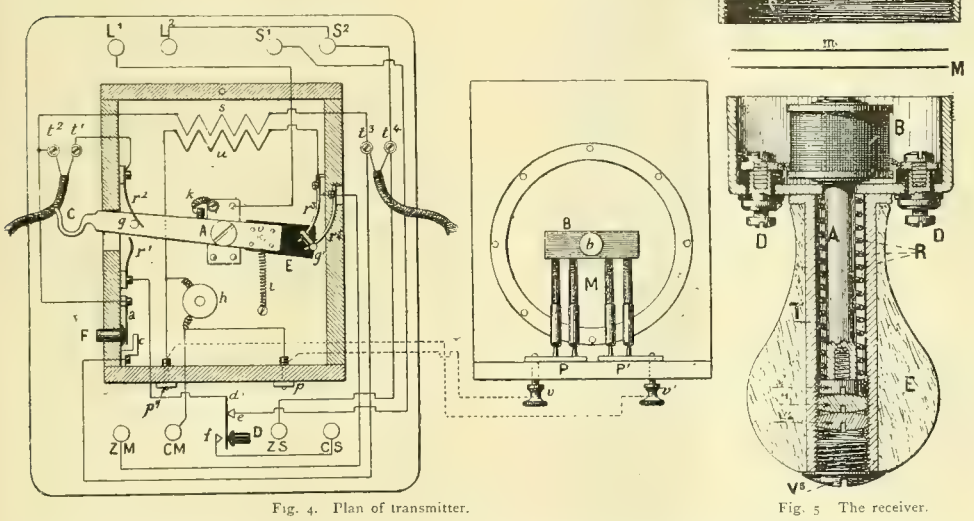



Fig. 4. Plan of transmitter.

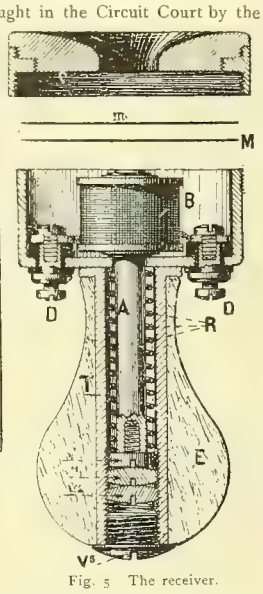



Fig. 5 The receiver.

MERCADIER AND ANIZAN'S COMBINED URBAN AND LONG-DISTANCE TELEPHONE.

Agents of the Harrison Telephone company have been looking over the field in Council Bluffs, Ia.

George Holmes, manager of the Pierre, S. D., telephone exchange, died suddenly last Saturday.

## Berliner Case to be Reviewed by the United States Supreme Court.

On September 3d there was an interesting proceeding in the United States Circuit Court of Appeals at Boston when the Berliner case came up. Judges Colt, Putnam and Nelson were present when J. J. Storrow, counsel for the appellant, in the case of the American Bell Telephone company against the United States, made a motion for a mandate dismissing the bill brought by the United States, in accordance with the decision of the court on the appeal of the Bell company. The court ordered the mandate to issue, whereupon Causten Browne, counsel for the government, took an appeal in open court, and the appeal was allowed. The appeal takes the case before the United States Supreme Court and has the effect of superseding the mandate, leaving the case in statu quo to be heard anew by the court at Washington.

## Telephone Bill for New York.

The Buffalo and Black Rock business men have shake off their summer lethargy and began their sessions for the winter. President Humphrey said that the telephone bill for which the association fought so hard last winter, was expected to come up again this winter, as some of the best lawyers in the state are now at work framing a bill which will have all the features of the old, and which will give better protection to the small telephone user. He then presented the following resolution for consideration:

*Resolved*, That the commercial organizations of this city are hereby invited to send three delegates to a conference to be held on October 1st (place and hour to be hereafter designated) to consider the advisability of continuing the effort to have legislation enacted at Albany that will reduce present telephone rates, so as to be about as outlined in the amended Persons-Gerst telephone bill of last winter.

*Resolved*, That the secretary notify said commercial organizations and request of them the favor of a reply, with advice as to names of delegates.

In presenting the resolution Mr. Humphrey said he thought the various commercial bodies should discuss the subjects, so that Buffalo will be a unit in its voice.

Alderman E. Tovey believed that the new bill should protect the small telephone users better than the old one did. A concern using but 500 messages should not be charged as much as one using from 2,000 to 5,000.

Justice Hill agreed with the speaker that the small user is deserving of more consideration. The resolutions were then passed.

## Another Victory for the Bell Interests.

[From the Boston correspondent of the WESTERN ELECTRICIAN.]

The American Bell Telephone company has recently added another to its long list of victories in the courts of this commonwealth, and a new phase in its litigation with the Western Union Telegraph company has recently been developed. On the third of this month a decision was rendered in the United States Court of Appeals in the case of the American Bell Telephone company, appellant, against the Western Union Telegraph company et al., complainants, appellees in favor of the Bell people. This suit, which was originally brought in the Circuit Court by the Western Union Telegraph company, the Gold & Stock Telegraph company and the American Speaking Telephone company, and continued by the Western Union company, was for an accounting from the Bell company alleged to have been the right of the plaintiffs under certain contracts made by them with the Bell company. The contracts gave the Bell company the right to use certain inventions for the transmission of messages that were owned by those companies, the Bell company agreeing to pay certain royalties. The plaintiffs claimed there was a large sum due them for royalties, and this the Bell company denied. After the case was begun in court, both sides made a stipulation refering the case to Hon. John Lowell as master for hearing, with instructions to report the facts and his rulings on any question of law arising in the case. The master heard the arguments and made his decision, communicating it to the counsel. Afterward he filed his report in the clerk's office, whereupon the Western Union company et al., the decision of the master being against them, moved the Circuit Court to allow them to dismiss their bill without prejudice to the bringing of another action for the same cause. That court did allow them to have their bill dismissed without prejudice, whereupon the Bell company took this appeal, claiming that at that stage of the case the lower court had not the right to dismiss the bill. The Court of Appeals holds that this contention isright.

The Los Angeles Consolidated electric railway has been sold for $1,500,000. The bondholders are the purchasers, and Col. A. H. Payson, of the Pacific Rolling Mills of San Francisco, bid in the property. Ex-Mayor Pond of San Francisco states that it is likely that the bondholders will sell the road and a new company be organized. If not sold to other capital, the purchasers, who represent 2,900 out of 3,000 bondholders, will go ahead with the improvements and give Los Angeles a fine street railway system. In the event of no further sale, there will likely be no change in the management. It is said the road is worth $3,000,000.

# COMMUNICATION.

## The Berliner Patent.

*To the Editor of the* WESTERN ELECTRICIAN:

The opinions expressed by the present judges of the Supreme Court, who sat in the celebrated telephone cases at the October term of court in 1877, as reported in Vol. 126, U. S. Rep., is especially interesting at this time to the telephone people of the United States. The Bell people proclaim that they are the sole owners of the right to use all forms of transmitting speech by the variable pressure process known at the present time. The patent under which they claim this monopoly is now before the Supreme Court as to whether the patent should not be considered void, abridged or sustained.

Mr. Justice Bradley, with whom Justices Field and Harlan dissented, said: "Mr. Justice Field and Mr. Justice Harlan [Justices Field and Harlan are now members of the Supreme Court and may sit in the Berliner case now before the court] and myself are not able to concur with the other members of the court, sitting in these cases, in the result which has been reached by them" (U. S. Rep., page 573). It seems that a majority of the justices then sitting, viz., Chief Justice Waite, Justices Miller, Matthews and Blatchford, decided that Bell discovered the art of transmitting speech by the aid of electricity. Though others had thought that they had discovered that art and had even transmitted speech by the aid of electricity, yet none had, prior to Bell, arrived at the true theory of such electrical transmission of sound. Those prior to Bell explained the theory as being made by a make-and-break circuit, while Bell discovered the true theory, which he showed could be done in two ways, viz., by increasing and decreasing the intensity of the current and by increasing and decreasing the resistance of the circuit in a "continuous" voltaic current. Bell showed that the circuit must not be broken during the transmission of speech, if such an expression may be used.

Bourseul, in 1854, said: "Suppose that a man speaks near a movable disk, sufficiently flexible to lose none of the vibrations of the voice, that this disk alternately makes and breaks the connection with a battery." Philip Reis said in a paper read before the Physikalischer Verein of Frankfort, Germany, in 1860: "In this way each sound wave causes a breaking and closing of the current;" and so did all telephonists before Bell explained the theory as being made by a make-and-break circuit.

Bell discovered the new and true theory and showed the error of the old and erroneous theory. The majority of the court decided that Bell's theory is an art and that Mr. Bell discovered this art, and in discovering this new art he was entitled, under the laws of the United States, to a patent.

Without entering upon the discussion of whether an art is a theory and a theory is an art, or that "theory" and "art" are synonomous terms, conveying the same idea, I will merely say that a minority of said court, sitting in banc, dissented in language clear and forcible, from which the following are a few extracts:

"We [Field and Harlan] are satisfied from a very great preponderance of evidence that Drawbaugh produced, and exhibited in his shop, as early 1869, an electrical instrument by which he transmitted speech, so as to be distinctly heard and understood, by means of a wire and the employment of variable resistance to the electrical current. This variable resistance was produced by causing the electrical current to pass through pulverized charcoal, carbon and other substances, acted upon by the vibrations of the voice in speaking. This was the whole invention so far as the principle of variable resistance is concerned" (U. S. Rep., page 574, second paragraph). "In regard to the instrument in which the principle of variable resistance was used, more than 70 witnesses were examined, who either testified to having seen it and heard it, or established such facts and circumstances in relation to it as to put its existence and date beyond question" (*Ibid*, fourth paragraph, first clause). "As it would serve no useful purpose to repeat the testimony of these witnesses, we shall refrain from doing so" (*Ibid*, page 575, second paragraph). "We do not question Mr. Bell's merits. He appreciated the importance of the invention, and brought it before the public in such a manner as to attract to it the attention of the scientific world" (*Ibid*, third paragraph). "It is regarded as incredible that so great a discovery should have been made by the plain mechanic, and not by the eminent scientist and inventor, yet the proof amounts to demonstration, from the testimony of Mr. Bell himself, and his assistant, Watson, that he never transmitted an intelligible word through an electrical instrument, nor produced any such instrument that would transmit an intelligible word, until after his patent had been issued; whilst, for years before, Drawbaugh had talked through his, so that words and sentences had again and again been distinctly heard. We do not wish to say a word deprecatory of Mr. Bell. He was original, if not first. He preconceived the principle on which the result must be obtained by that forecast which is acquired from scientific knowledge, as Leverrier did the place of the unknown planet; but in this, as in the actual production of the thing, he was, according to the great predonderance of the evidence, anticipated by a man of far humbler pretensions" (*Ibid*, page 576, second paragraph, fourth clause).

Thus we have the opinion of two justices who, if alive, will undoubtedly sit on the case now before that court, entitled the United States of America vs. the American Bell Telephone company and Emil Berliner. It will be seen that Justices Field and Harlan were satisfied that Drawbaugh produced and exhibited as early as 1869 an electrical instrument by which he transmitted speech, so as to be distinctly heard and understood, by means of a wire and the employment of variable resistances to the electrical current; that Drawbaugh employed a plate in combination with the electrodes, so called; that Drawbaugh produced electrical undulations similar in form to sound waves by causing sound waves to vary the pressure between the electrodes in constant contact (for since Bell has shown that the true theory of the transmission of speech by aid of electricity could be done in only a continuous voltaic current); that a continuous voltaic current can exist only when the electrodes are in

in perfect contact, consequently a constant [illegible] continuous undulatory current, so far as effect is concerned, are one and the same thing. Since Drawbaugh used a plate by which he was enabled to produce undulations similar in form to sound waves by the agency of the voice, he therefore produced electrical undulation similar in form to sound waves by causing sound waves to vary the pressure between the electrodes in constant contact. And since Drawbaugh did this prior to Mr. Bell's discovery, and Bell's discovery was prior to Mr. Berliner's invention, therefore Drawbaugh anticipated Berliner.

The question now arises, Will there be any new light thrown upon this controversy sufficient to cause Justices Field and Harlan to change their opinion? All the justices who decided in favor of Bell are now dead, so it would be taken, upon the doctrine of chances, that the majority of the judges will be against the legality of the Berliner patents.

A. B. STROWGER.

*Chicago*, September 9, 1895.

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## Ruling of Patent Commissioner in Important Telephone Controversy.

An important decision by the patent commissioner has been made public which will have considerable interest for telephone men. It is the result of a review of the Scribner-Kellogg controversy over the multiple switchboard patent, and the commissioner reaffirms his finding of March 2d, when he awarded priority of invention to Scribner. The commissioner summarizes the points raised in the controversy as follows:

(1) Where it appears that Scribner produced a sketch and described the invention to others on September 9, 1887, made and tried a model in April, 1888, and applied for a patent on June 19, 1888, and that Kellogg was not engaged upon the invention until December 1, 1887, but applied for a patent March 3, 1888, and it is accordingly held that Scribner was the first inventor.

(2) Where it appears that Scribner was the first to conceive the invention, but he forebore to apply for a patent during the progress of his experiments and until he had perfected his invention and tested its value and sought and devised means of overcoming objections, and it is accordingly held that he was using reasonable diligence in adapting and perfecting the invention from the date of conception to the date of filing his application.

The application of Charles E. Scribner was filed June 19, 1888, No. 277,557; that of Milo G. Kellogg, filed March 3, 1888, No. 266,081. Following is the decision:

This is a rehearing of the commissioner's decision rendered March 2, 1895, awarding priority of invention to Scribner on the following issue:

The combination, with several telephone lines connected with multiple switchboards, each being provided with an individual annunciator, of a coil of a different converter included in each line between the switch of the line of the last board and its individual annunciator, the different converters being energized by pulsatory or undulatory currents sent through the circuit of their primaries and means for automatically opening the portion of the circuit of the line which includes the converter when a connection is made therewith at any of the switchboards.

In small telephone exchanges all the lines may be connected to a single switchboard, where the operator can tell at a glance whether a line that is wanted is busy. No test is required. Where, however, the number of subscribers' lines is large, the calls sent in cannot all be answered at a single board.

Hence a number of separate boards, each with an operator, is provided, and each line of the exchange is connected to a switch on each board, but part of the lines are assigned to have their calls answered at one board and part at another's.

Annunciators for all the lines to be answered by one operator are placed upon the section of the board under his care, where any line having an annunciator upon his section of the board may be connected upon call with any other line coming in at that station, wherever its annunciator may be, and similarly of other sections of the switchboard; but in such exchanges a test is necessary which will show to the operator whether the line called for by the subscriber, if its annunciator is not upon his section of the board, is busy, for obviously it may have been connected with another line at another section of the board.

A patent for a test system for multiple switchboards was granted to Kellogg November 18, 1884, No. 308,315. Its essential apparatus was a spring-jack on each board for each line, a pair of contacts for each jack, open so long as no connection was made at that jack, but closed by the insertion of a connecting plug into the jack, a test battery, and a test instrument—for example, a bell for each board, a test contact for each jack, all the test contacts of each line being permanently electrically connected, and a plug or other device for making the test. Its operation was as follows: The insertion of a connecting plug into a socket for making the connection of any two lines for conversation besides making such connection also closes a pair of contacts at that jack, which connect one side of the test battery at each board with the test contacts of that line at each board. An operator at another board in testing this line applies his test plug to the test contact, thereby connecting the other side of his test battery to this contact. This completes the circuit and the bell responds. Thus the test circuits forming no part of the talking circuit are normally open at two points, one of which is closed at the jack when a connecting plug is inserted, the other when the test plug touches the test contact. The test was not a test of the talking lines, but of the local test circuit only, and this was automatically connected for the test by the same changes that connected two talking circuits together for use by subscribers.

An early patent was granted to Scribner, No. 305,021, on September 9, 1884, for a test system, the essential features of which were a spring jack for each line on each board, a test contact on each jack, all test contacts for each line being permanently electrically connected, a test plug and a test instrument—for example, a telephone—for each board. In circuit with each test plug was the test instrument, and there might be a battery, though this is not essential. The jacks were so connected that the insertion of a plug into any one of them connected all the test contacts of that line to the line wire. When an operator at another section of the board applied his test-plug to the test contact of such a line, he heard a click in his telephone, because the current from his battery found circuit through the test plug and contact to line and to ground at the subscriber's station. In case no test battery were used, an induced current or earth current usually present on grounded lines found circuit through the operator's telephone to ground. The test was a click for busy lines and silence for free lines, the click being made when the test plug touched the test contact and another click when the test plug was brought away.

Another patent was granted to Scribner, No. 330,061, November 10, 1885, for a multiple switchboard and the means of testing for free and busy lines, in which the circuits were so arranged that any two lines might be connected together upon any one of the boards without including in their circuit the resistance of the contact points of the switches.

In his earlier patent, just described, the contact points of the switches were included in the circuit of every two lines when connected together, except those connected at the first board. The essential features of the improvement in his last mentioned patent, now to be described, were a spring jack on each board for each line, a test contact for each jack, all those for each line being permanently electrically connected with one another and with the line, a pair of contacts for each jack, normally closed, but opened by the insertion of a connecting plug into any jack, the pairs of contacts being connected in series with the test circuit. In one form there was provided an induction coil having its secondary in the test circuit and its primary in a local circuit containing a battery and circuit-breaker. There was also provided a test plug and test instrument—as, for example, a telephone. The test circuit was so connected that it was normally open at one point only—that between the test plug and the test contact. When an operator made the test, he heard a buzz in the telephone if the line was free, since the induced current from the induction coil found circuit through the spring jacks and telephone to ground. If, however, the lines were in use, the test circuit was broken at that jack where the connecting plug was inserted and he heard no sound. An alternative means for producing a sound, a mere click instead of the buzz on free lines, is also described, but may be neglected for the purposes of the present discussion.

The things to be noted are that Scribner had in 1885, and earlier, the means of producing a characteristic noise upon telephone lines that were free and had subscribers' lines so connected on a multiple switchboard that this characteristic sound was the test for free lines and silence for busy lines. It is also to be noted that Scribner produced this characteristic noise by a converter whose secondary was in a circuit common to several lines joined together after passing through their individual annunciators.

Scribner calls the invention of this interference an improvement upon that of his patent No. 330,061, of November 10, 1885, and between the two the chief difference is that this issue calls for a coil of a different converter included in each line between the switch of the line on the last board and its individual annunciator, whereas his patent of November 10, 1885, describes a common circuit for several lines, made by bringing several lines together after they have passed through their respective annunciators, leading them thence in one circuit through the secondary to ground. The separate coil of a different converter of the same is upon the other side of the individual annunciator as a consequence of the use of separate coils for each subscriber's line. However, the lines when free are affected by induced currents originating in a converter, and when a connection is made at any spring jack between two lines that part of the line forming the test circuit which extends from the contact points through the annunciator, through the converter, and to ground is cut off automatically by the insertion of the connecting plug.

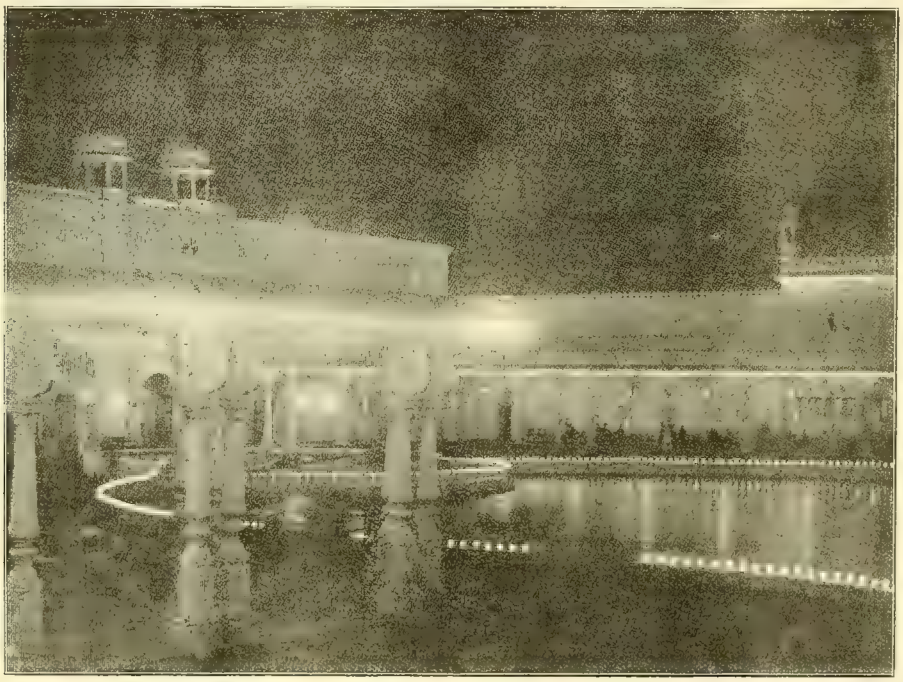
Another patent to Scribner for a test circuit for multiple switchboards, No. 427,120, was granted May 6, 1890, upon an application filed December 27, 1886. Its essential apparatus was a spring jack on each board for each line, a test-contact for each jack, a pair of normally-closed contacts for each jack, those of each line being connected in series, a continuously-operative circuit breaker for each line, a ground test-circuit, including a telephone, battery and test-plug. The apparatus is illustrated and described as applied in a mixed exchange, including metallic circuits and grounded circuits. The continuously operated circuit-breaker is normally in circuit with the line and the pairs of normally-closed contacts in the spring-jack; but as there is no battery in the circuit the line is not affected. When the free line is tested, circuit is made from ground through the test instrument, battery, test-plug, test-contact, circuit-breaker and the closed contacts of each jack in series to ground. The operator hears the characteristic noise of the circuit-breaker, the line being free. When a plug is inserted in a jack, thus making connection between two subscribers' lines, the contacts of that particular jack are thereby opened, and this cuts off that part of the test-circuit containing the circuit-breaker, and there is silence on testing.

Another patent was granted to Scribner upon the same date, No. 427,121, for a multiple-switchboard testing apparatus, upon an application filed December 27, 1886, the essential apparatus for which was the same as that in Patent No. 427,120, just described, except that a buzzer was substituted for the continuously operated circuit-breaker, and the operation is the same, except that the buzzer operates only when a test is made on a free line. It is set in vibration by the test-battery when the test-circuit is complete and causes a characteristic noise in the telephone when the line tested is free, and the test is silence for busy lines.

After the applications for the last two patents had been pending in the office for more than eight months there was on September 9, 1887, a telephone conference in the city of New York, at which Scribner, E. J. Hall, Jr., of New York, W. W. Jacques of Boston, W. D. Sargent of Brooklyn, J. P. Davis of New York, W. R. Patterson of Chicago and Angus S. Hibbard of Morristown, N. J., were present. Stenographic notes were taken, and that portion claimed to concern the present invention, was, under objection, inserted in this record. The objection, however, was not insisted upon in argument and it was admitted by counsel for Kellogg that the stenographer's notes are a true statement of what occurred at the meeting. Scribner produced a sketch and described to the conference a test system the essential features of which were spring-jacks upon each board for each subscriber's line, a pair of contacts for each jack, through which the circuit was conducted, an annunciator beyond the last board, a mechanically-operated circuit-breaker beyond the annunciator, through which the circuit was conducted back to the frame of each spring-jack and to ground. There was a test-plug, telephone and battery in a test-circuit to ground. The insertion of connecting plugs at any two spring-jacks on different lines not only connected the two subscribers' lines together, but automatically cut off the vibrator from both the lines connected.

The recital of Scribner's patents and applications then pending is useful in order to know Scribner's mental equipment at the time at which he claims to have disclosed the invention of this issue to Patterson and others. All such matters were accessible also to Kellogg, except the contents of Scribner's pending applications; but they have not the same bearing upon Kellogg's case, because it is shown that Kellogg was not engaged upon the special problem in controversy until December 1, 1887.

It is claimed by Scribner that this conference system was the precursor of the improvement embodied in the issue. It is claimed by Kellogg that this is not so; that the issue



ELECTRICAL ILLUMINATION OF EARL'S COURT, LONDON.

...exceedingly narrow and consists precisely in the coil of a different converter included in each line between the switch of the line on the last board and its individual annunciator, the different converters being energized by pulsatory or undulatory currents sent through the circuit of their primaries; that the circuit breaker is essentially different from the converter as an element in the issue; that the circuit-breaker system was recognized by Scribner as different from the issue in that he had applications for the circuit-breaker system pending in the office, upon which he subsequently took out patents—the last two hereinbefore described—and that after this conference of September 9, 1887, he worked out the system now under consideration and applied separately for a patent for it on June 19, 1888.

In conducting this improvement to successful reality it must be borne in mind that there was sought a better means of producing a characteristic noise as the test for busy lines than any shown in the patents hereinbefore described, or in Scribner's applications then on file, and that the difficulty met with was from the induced currents on busy lines arising from the pulsating current on free lines. This difficulty would not present itself in telephone systems consisting wholly of metallic circuits, where the induction on each limb would neutralize that of its companion. Scribner tried in turn producing the conditions of a pulsatory current on each free line, yet leaving the line free from current except at the moment of the test. To avoid the vast multitude of circuit-breakers he had tried the converter with a number of subscribers' lines connected together before they reached the converter. He had tried the buzzer on each line so arranged as to be at rest except at the moment of the test and to be excited to action by the battery in the operator's test-circuit. As before stated, he had every element in mind in combinations analogous to that of this issue, if not identical with it, including the converter, broadly speaking, as a substitute for the circuit-breaker and including the converter upon lines so connected that one converter would answer for several lines, and he had such combinations constructively reduced to practice in his patents or in his allowable applications before Kellogg had taken up this particular problem.

Taking up the subordinate points of controversy for decision, it is thought that while the circuit-breaker and the converter were not strictly mechanical equivalents in the relations prescribed by this issue the circuit-breaker system was the precursor of the system described in this issue in the sense that to work over it was not to abandon the improvement of this issue nor to suspend work upon it. It is thought, too, that Scribner described the mechanism of the test system in issue to Patterson as early as September, 1887, on their way home from the telephone convention in Pittsburg. It is objected to this conversation between Scribner and Patterson that it does not disclose the invention; that it is so general that it might apply equally well to the circuit-breaker system of the conference of September 9, 1887, or to considerable variations from that in issue, and it must be confessed that the first testimony of Scribner leaves that matter vague, and that the direct examination of Patterson is not sufficiently full; but Patterson was cross-examined with ability and skill, and states that he did not give all the conversation upon this point between Scribner and himself, and remembers that a part of that conversation was with reference to the extra cost of an induction-coil for each line, and that there was discussion as to how many primary circuits could be connected together. There the examiner dropped the subject. But Scribner was further questioned at page 11 upon the subject of his disclosure to Patterson and more fully recounts what was said.

Since Patterson and Scribner were both skilled electricians, the conversation appears to be full enough for Patterson's comprehension of the improvement and to enable him to identify that which was disclosed as the same as that of this issue, and he does identify it as the same. It is not a subject about which Scribner and Patterson could be honestly mistaken. They knew whether the conversation on the way home from Pittsburg in September, 1887, concerned the improvement of this issue, or the circuit-breaker system, or some other. Since the conversation developed in the record is sufficiently explicit to identify the invention and is as explicit as opposing counsel at the time desired, it must be found that the conversation took place at the time testified to. Nor is the fact of importance, if it be so, that the conference system was the circuit-breaker system for which Scribner had applications then on file in the Patent Office. Whether he sought to patent that system—the circuit-breaker system—or not, it might in either case equally well be that he treated it as a stepping-stone to reach the full invention of this issue.

Angus Hibbard, also an electrician, who was present at the conference of September 9, 1887, considered that the substitution of the converter with the separate coil for each one of several subscribers' lines was different in detail, but not in principle, from what Scribner had developed in earlier conversations with him; and both Hibbard and Haskins consider, and considered at the day and time of the event, that Scribner was the originator of the idea of employing a converter with separate secondary coils for each of several subscribers' lines, located as called for by this issue, and that the partial test and the model soon afterward constructed were the embodiment of Scribner's idea.

The telegraphic communication between Scribner, in Chicago, and E. M. Barton on December 14, 1887, while not affirmative proof of any conception of Scribner prior to that time, is yet wholly consistent with such prior conception and induces a belief in its probability. In the evolution of this invention in Scribner's mind the characteristic noise was at one time to be produced by a vibrator always in motion with current sent over the line only at the time of the test, at another by a vibrator or a converter in action only at the time of the test, at another by a vibrator always in action, with a current always over the free lines, and in each case the vibrator or circuit-breaker was cut off by connection with any two lines for conversation, no matter at what board the connection was made. If these are not the embodiment of the gist of the invention, they are the legitimate antecedents of it and show progress toward the complete invention, as well as recognition of defects that go far to leave it impracticable.

As thought out by Scribner in September, 1887, it was applicable to metallic circuits. His connection with telephone exchanges, then consisting in this country almost wholly of grounded lines, in his estimation required him to provide against objectionable induction developed in such lines. It is unnecessary to recount his experiments, which convinced him that without the perfection of details the improvement would be practically useless, because the whole system would be, as he expresses it, "on a buzz." It is enough that he anticipated this difficulty and that in view of it his further tests were temporarily suspended. The difficulty was met and perhaps overcome by him by the employment of a generator which should transmit inaudible pulsatious to all of the lines through the converters and by employing a vibrator in connection with the operator's test-circuit which should render the pulsations audible to the switchboard operator that would be inaudible to subscribers. Scribner worked out the details, tested the invention, and perhaps overcame the difficulty arising from induced current on grounded lines, although this is not certain, nor is it necessary to decide that point. Under his direction a model was made and tried in the latter part of April, 1888. His application for a patent followed in due course on June 19, 1888.

On December 3, 1887, Kellogg, in Chicago, having conceived this invention, disclosed it to Blanchard. This disclosure has been much criticised by counsel for Scribner; but in the absence of cross-examination of Blanchard sufficient to disclose his want of comprehension of the invention it ought to be found, and is found, from the fact that Blanchard made drawings from notes and directions given by Kellogg, and from the fact that Blanchard testifies that he understood the invention at the time, and in the absence of any answer from him tending to show that this was untrue, that the disclosure to Blanchard is proved and is sufficient. It is thought, also, that the invention as formulated by Kellogg is not impractical, as Scribner's counsel contends, although it appears to be in a form inapplicable to grounded lines.

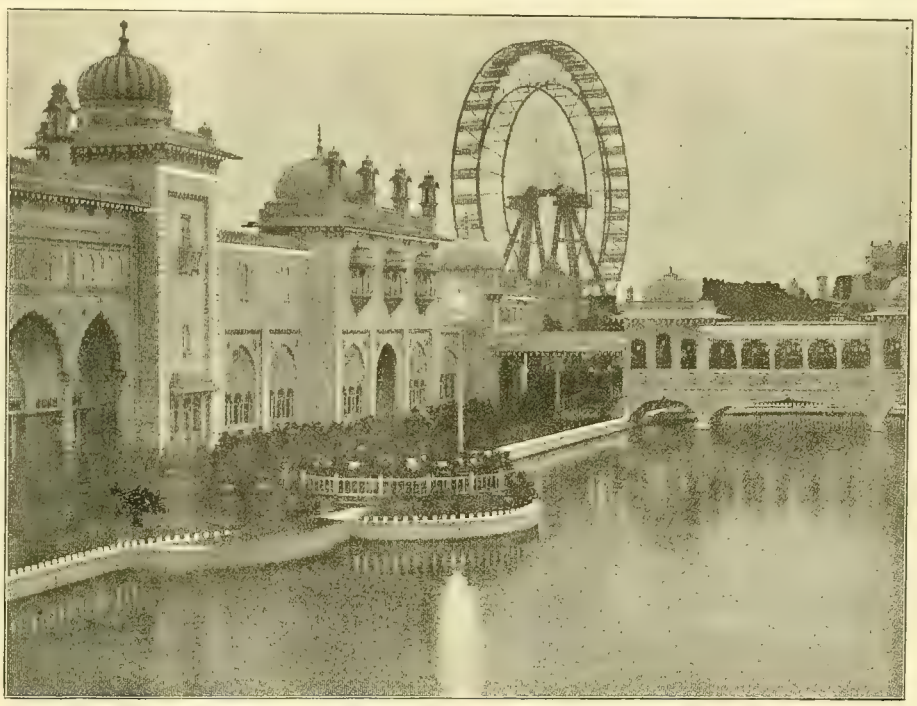
Upon the whole record it is found that Scribner was the first to conceive this invention; that he forebore to apply for a patent during the progress of his experiments and until he had perfected his invention and tested its value to the fullest extent possible, except in a complete telephone exchange; that he patiently elaborated it in its working details and sought for and devised subsidiary means of overcoming the induction in grounded lines, and thus that Scribner was using reasonable diligence in adapting and perfecting his invention from the date of his conception to the date of filing his application,

It is claimed by Kellogg that when, on the 14th day of December, 1887, Scribner, in Chicago, was informed by telegram from New York by E. M. Barton, the president of his company, that Angus S. Hibbard had a new test for the Cortlandt street exchange, then building, which Haskins, the electrical engineer of the Western Electric company, had examined, and which turned out to be in substance the same as Scribner's September conception, and when Scribner replied that he was afraid it would not work, that he had made a diagram of the same thing and had given it up because the constant buzz of not-busy lines would induce a buzz on busy lines and would make them test busy and the whole system would be on a buzz and it would be impossible to kept it off from busy lines, Scribner thereby abandoned his earlier concep ion and so much of this invention as had been conceived of by him at that time. Nevertheless he directed that a tes: be made, and suggested that it should be tried on pretty long cables. The test resulted in verifying Scribner's anticipations of its deficiencies, hereinbefore discussed, and yet proved the general merit of the invention and that it might be further developed into a successful thing. It would seem to be a harsh construction to put upon this language of Scribner's to the chief officer of his own company to hold it as conclusively showing an abandonment of his invention as thus far developed, and such construction should not be put upon it unless the inexorable rules of evidence require it. Rights are not ordinarily shown to be abandoned except by proof of acts indicating it upon which opposing rights are built up. Had Scribner used this language to Kellogg it might justify Kellogg in assuming and acting upon the assumption that the field of invention was open to him for all that Scribner had done. Under the circumstances of this case, and with other language in the same conversation directing further tests to be made, I cannot find in the mere words "I gave it up" ground for holding that Scribner left the field.

The decision of the examiners-in-chief in awarding priority to Scribner is affirmed.

## Electrical Illumination of Earl's Court, London.

Doubtless many will be reminded by the accompanying illustrations of the night scenes at the World's Fair, but a closer examination will reveal the fact that while there is a suggestion of the familiar scenes in these views there is an absence of the grandeur of the picture presented by the Court of Honor at Jackson Park. The cuts are reproductions of photographs showing the electrical illumination of Earl's Court, London, and as comparatively few Englishmen saw the great exhibition at Chicago, it is not to be wondered that they make much of their own miniature display. According to the London *Electrical Review*, it is conceded that the most brilliant spectacle in London at the present moment is to be found at Earl's Court. At nightfall many thousand lamps are being utilized to render still more attractive some of the most charmingly wrought surroundings that have ever graced an exhibition. The lighting of Queen's Court, depicted in the illustration, is a most creditable achievement, but perhaps the most striking feature is the extraordinary care that has been taken in making the electric light fittings and wiring as substantial as possible. There are no ugly casings and still uglier metal pipes to mar either wall or building, the wires being in most cases hidden. The *facade* of the Queen's Court is in pure white, loggias connecting it with the Ducal Palace. It will be seen from the illustrations that the eaves and corners of the buildings and the loggias have been picked out with electric lamps, and when the whole of the lights are on, the scene is a most brilliant one. There are about 2,000 incandescent lamps in the Queen's Court, exclusive of a few arc lamps that are also used. The incandescent lamps are placed two in series, the mains which feed them being laid underground. In front of the Ducal Palace is the electrically illuminated fountain. The illumination of the fountain is done from beneath the basin, the space here being utilized both for the searchlights and transformers for the incandescent lamp circuits. The beam of light from the searchlights is usually reflected upward to the water spray. However, the electrical effects have to be seen to be appreciated. The lighting of the theater, which, by the way, is said to be the largest in the world, is exceptionally interesting. The stage lighting is controlled from a platform high up among the clouds. A complete set of choking coils have been fixed up here for the purpose of lowering the lights on the stage battens. By a suitable arrangement of machinery designed by Mr. Fricker and Mr. Money, the whole of the choking coils can be operated at once, thus lowering the whole of the lights, or the choking coils can be operated singly, thus lowering the lights on one batten. On the lake, which is in the middle of the ground, there are electric launches which are quite in keeping with the surroundings; these are lighted by small incandescent lamps.



ELECTRICAL ILLUMINATION OF EARL'S COURT, LONDON.

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AN appeal has been granted by the United States Circuit Court of Appeals in the Berliner case, and the United States Supreme Court will review the proceedings. Until a decision has been handed down by that court the question is open. In the meantime it is expected that the Bell company will continue to "defend its rights."

As a practical exponent of the art of resuscitating persons supposed to have been killed by electric shocks, George A. Redman of Rochester, N. Y., is making an enviable record. His old Brush station under the lower falls of the Genesee river is coming to be of historic interest on account of the late experiences in this line.

WHEN the New York state association of street railway companies meets at Albany on next Tuesday it will in all probability take some action to head off the adverse legislation proposed by the last Legislature. Several bills will come up at the next session of the Legislature that will seriously affect the street railway interests of the state. Some of these are no doubt simply blackmailing schemes, but there are others that will be pushed vigorously, and they should be looked into carefully.

PENDING the outcome of the Berliner litigation telephone men will watch with interest the movements of the Bell company and its allies in their efforts to fortify their position. On this account the decision of Patent Commissioner Seymour on the Scribner-Kellogg controversy, which is presented on another page, is of special importance at this time. The Bell company is eager and anxious to take advantage of every point that will strengthen its position, as is evident from the vigorous manner in which it pressed the claims of Scribner in this case. The decision of the patent commissioner in affirming the findings of the examiner after carefully reviewing the case and taking into consideration all the arguments presented, sustains the wisdom of the policy adopted by the Bell interests. It is evident that the Bell company proposes to be in position to fight, even though the Berliner litigation terminates in an adverse decision.

IN many places local telephone companies have made the mistake of disregarding public opinion, constructing lines without permission from the municipal or village government and resorting to similar practices that cannot fail to provoke resentment. As a result these corporations are watched closely by the public and favors are dispensed with reluctance, owing to public prejudice against these corporations. A case in point is furnished by a Wisconsin town which last week granted a franchise to a telephone company. However, the necessary preliminaries for the protection of the city had not been complied with when the company commenced the construction of its pole line. This action very naturally aroused the ire of the local officials and they resented the company's presumption. Arrests of employes, destruction of property and legal proceedings followed and now the company is in disfavor. It is really amazing when one calmly considers the stupidity of telephone managers in thus provoking hostility at the very beginning. How can they expect friendly offices or encouragement when they disregard every right which the people possess and fly in the face of public opinion?

TWO CONVENTIONS will be held in Canada this year that will attract the attention of the electrical fraternity of the United States. The first, that of the Canadian Electrical association, will be opened at Ottawa next Tuesday, and it gives promise of being an interesting meeting. The organization includes among its members representatives of every department of the electrical industries of the Dominion, and it has done much to improve the condition of affairs by providing a means of intercourse, encouraging exchange of ideas and discussions of practical subjects and the solution of perplexing problems that affect different branches. It has fostered a good feeling among the representatives of the several interests, with the result that there is less friction between them than prevails on this side. For that reason, if for no other, we should watch our Canadian friends and emulate their example. We trust that the Ottawa convention will be as interesting and valuable as former meetings of the organization.

The other convention will be held at Montreal on October 15th, and it is a foregone conclusion that it will be an enjoyable affair. The meetings of the American Street Railway association are always well attended, and under the circumstances this year's event may be expected to hold out special inducements. Those who have partaken of Canadian hospitality, as dispensed at Montreal, will make an effort to return to those pleasant scenes and renew the acquaintances they formed on former occasions.

THE general impression that the failure of the Milwaukee Street Railway company to make money was the fault of the management and the manipulation of the securities of the company for the benefit of a few of the stockholders, seems to be confirmed by the announcement of Henry C. Payne, one of the receivers of the company, that within 60 days the receivership of the company will be abolished. For the first time in the history of the corporation the statement is officially made that the company is making money. In his statement the receiver says: "During the last three months the increase in the business of the road has been something enormous, especially on the lines to the public parks. This increase I attribute to the general improvement in business conditions and to the improvement and attractions at the public parks. During the receivership we have expended $80,000 in improving and extending the road. Notwithstanding this outlay the road is in good financial condition and is making money." Further evidence that the road's financial policy has been at least ill-advised is presented in the announcement that the bonded indebtedness of the road, which amounts to $12,685,000, of which there is outstanding $11,681,000, under the plan of reorganization will be scaled down about one-third, or to about $8,000,000. It is claimed that the road can be made to pay a fair dividend on this amount. At the time the road was placed in the hands of receivers one of the principal causes assigned for the necessity of the move was the hostility of the Common Council to the interests of the street railway company. The attitude of the council, no doubt, hampered the management, but did not produce the condition of affairs which made the receivership necessary. Bad management, or worse, as has been charged, was the chief cause of the company's embarrassment.

AS LONG as there is a telephone company in Chicago and a druggists' organization to fight it, there is bound to be trouble. So far as the public is aware the chief object of the Chicago Retail Druggists' association has been to fight the telephone company, and no one will question the ability and willingness of the organization to maintain a vigorous and protracted struggle against the "giant monopoly." As a rule the public looks on and enjoys the scrimmage as much as the contestants. Generally speaking, too, the public is strictly impartial, giving moral support to the druggists and financial backing to the company, and as this arrangement is highly satisfactory to all parties concerned the war goes on right merrily. During the many years in which the association and the company have been engaged in this struggle, it has been difficult at times for members of the organization to clearly define the principles for which they were fighting, the grievance they complained of or the improvements they demanded, but they have fought on valiantly and at the present outlook they promise to continue to fight to the end of time. At the present time the druggists are experiencing a little trouble on account of the failure of some of their members to comprehend the situation and their natural inclination to oppose everything which the telephone company favors. Just now the question that is uppermost in the minds of the druggists is the proposition that the company put in automatic telephones which will require the person who desires the service to pay for it in advance. Many of the members say this is a device of the enemy and that their old antagonist has gotten some unsophisticated members to father the scheme. The proposition will be submitted to the association and passed upon by that body after the usual number of speeches have been made and resolutions adopted. It is not expected that it will be disposed of for some time; meanwhile the company is busy filling the orders of individual druggists for what they are pleased to term the new-fangled machines.

AS ANNOUNCED in the last issue of this journal, the ruling of Judge Tuley on the ownership of street railway tracks, the rights of respective companies to the use rails laid in public highways, and the power of the company laying the rails to exact rental for the use of them by other corporations, will be tested by an action for damages instituted by the Chicago General Railway company against the John Spry Lumber company. The complainant asks for $1,000 damages for the use of its tracks during the last three years by the defendant company. The plea of trespass is entered and 25 cents per load for 4,000 loads of lumber which obstructed the tracks at different times is asked as a fair compensation. The argument of the street railway company is based upon the recent decision of Judge Tuley and upon a section of the city code providing for a penalty of $5 for obstructing the progress of street cars "by placing, driving, stopping or causing to be driven at a slow pace or stopped any vehicle or any obstacle in, upon, across, along or near said tracks in the way of any car, if there shall be an opportunity to turn off, after being notified by the ringing of the car bell." In the decision alluded to Judge Tuley says that "the railroad company has obtained not only a binding contract with the city under the decisions of our Supreme Court, but an easement in the street, and has a property right in the rails so laid and the uses thereof, of which it cannot be deprived except upon just compensation as ascertained (and paid) as provided by law." The judge proceeds to emphasize the statement that the railway company has a property right and interest in the rails, of which it cannot be deprived without just compensation, etc.; and then he adds: "It is unnecessary to exactly define the extent of this property right, as, if it exists at all, it is entitled to protection as private property, which cannot be taken for public use without compensation." Furthermore, the judge lays down this rule, which will be generally accepted: "Corporations stand before the law on the same footing as natural persons, and are entitled to the same protection of their property in every respect, no less and no more. Property belonging to a corporation is as much 'private property' as if the same belonged to a natural person." It will be borne in mind that the opinion from which these quotations are made was given in a case in which an adverse decision was made upon the claim of the General company to operate cars on the tracks of the Chicago City Railway company. The complainant, while assuming in this case that Judge Tuley's ruling is good law, is anxious to have the decision reversed. The case is attracting attention everywhere.

## New Chicago Office of the Postal Telegraph Company.

About October 15th the Postal Telegraph-cable company expects to remove its Chicago headquarters to the fine new building of the Chicago Stock Exchange, at Washington and La Salle streets. At present the main receiving office is in the Western Union building, at Clark and Jackson streets, while the executive and operating departments are in the adjacent Imperial building, on Clark street. The quarters in the latter building are totally inadequate, and the company is equipping an entirely new plant in the Stock Exchange building in consequence. The office in the Western Union building will be retained, but the main receiving office will be at the corner of Washington and La Salle streets. This change marks a curious transposition in the Chicago offices of the two great telegraph companies. For many years the Western Union company was established in the old building on the site of the present Stock Exchange. About two years ago it purchased the building at Clark and Jackson streets, in which its rival had a long lease of the principal store, and moved its plant to that location. Now the Postal company is about to leave this locality for the precise site so many years occupied by the Western Union.

The machinery plant of the new equipment will be located in the basement, and the motor-dynamos will be supplied with current from the machines furnishing current for lighting the building. The receiving office will be on the ground floor, in the corner of the building. The entire thirteenth floor will be occupied by the executive offices and the operators' quarters. Here will be the offices of Mr. Parker, the general superintendent; Mr. Nally, assistant general superintendent; Mr. Baker, superintendent of construction, and Mr. Butterfield, assistant electrical engineer. The operating room will contain sittings for 280 operators, each equipped for typewriting machines. In addition there will be a general office, book-keepers' office, file room, a club and reading room for the operators, with lunch room attached, a wardrobe room, with wire lockers, and toilet rooms for men and women. Everything will be entirely new, and the fittings will be modern and handsome. The establishment will represent the latest advances in the art of commercial telegraphy. The building is peculiarly well adapted for the purpose, having, for one thing, an elevator vent running from the basement to the top, which could not have been better placed for containing the cables if designed for that purpose. All accessories of pneumatic tubes and automatic speaking-tube apparatus will be provided to connect the various offices and rooms.

## Complete Absence of Smoke.

"The attention that is being given nowadays to down-draught furnaces and smoke consuming devices reminds me of a little incident in connection with the Detroit meeting of the American Society of Mechanical Engineers," said a well known steam engineer recently. "I was induced by a friend who was interested in one of these furnaces to visit a plant in company with several delegates to the convention, with the understanding that we were to be shown the very latest type of down-draught furnace in practical operation. We had quite a long trip ahead of us, and as the day was a scorcher it required considerable work on the part of our guide to persuade us to undertake the trip that day. Finally we consented and when we were nearing the point where our guide proclaimed this wonderful furnace was in operation, he said: 'Now, you will see my stack up there' (pointing as he spoke to a new chimney). 'They have got a flag on top of it, and you see, although they are burning the poorest kind of Illinois coal, the flag is not even dirty. If a —— furnace were not used in that station the smoke would roll out and fill the atmosphere and soil your linen. As it is, everything is perfectly clean.' By this time the party had reached the entrance to the station and our guide said to us: 'Come along, gentlemen; come right in now and examine the workings for yourself.' We entered the plant and found that we were 'in the wrong pew.' They had a brand new stack, with a man in it lining it up, and there was not a boiler within a mile of it."

## Look Alive, Neighbor!

We feel constrained to advise our worthy contemporary, the WESTERN ELECTRICIAN, that, in its zeal for the protection of the Chicago public against the machinations and monstrous outrages of City Electrician Barrett, it has missed one of the most important pieces of electrical news we have had during the dog days. We refer, of course, to the announcement of plans for the improvement of Chicago's water supply, by the addition of auxiliary pumping stations to be worked by electric motors.

Brother Kreidler will be after his young men with a sharp stick unless they are more alert.—*Electrical Journal.*

Don't worry, gentlemen; don't worry. Or, at least, let not your fears take that direction; for in due time it will appear that no part of the Barrett record has been "missed."

## Canadian Electrical Association.

The fifth convention of the Canadian Electrical association will be hled at Ottawa on September 17th, 18th and 19th. The secretary announces that nothing has been left undone to make this the most interesting and enjoyable meeting ever held by the association. Ottawa, as the capital city of the Dominion, will itself well repay a visit, and, in addition, the most complete arrangements have been made by the local committee for the entertainment of visitors to this convention. Favorable railway and hotel arrangements have been secured for members and ladies accompanying them, so as to insure as far as possible a large attendance. The headquarters of the association will be the Russell House.

At 11 o'clock next Tuesday morning there will be the formal opening of the conventionin the railway committee room of the House of Parliament, when the mayor will read an address of welcome. At the conclusion of the address members and ladies will be shown through the Senate, the House of Commons and Parliamentary Library. The first business meeting will be held at 2.30 o'clock at the Board of Trade Tuesday afternoon. After the president's address there will be reports of officers. The meetings will continue on Wednesday and Thursday, and the following papers will be presented and discussed: "Some Notes on the Consolidation of Two Systems of Electric Supply," by A. A. Dion, Ottawa; "The Telegraph in Canada," by Charles P. Dwight, Toronto; "Suggested Forms for Electric Light Accounting," by D. R. Street, Ottawa; "From the Coal Pile to the Meter," by James Milne, Toronto; "Some Modern Alternating Current Apparatus," by H. T. Hartman, Peterborough; "Non-Interference Diplex Relay, and a Percentage Method for Circuit Measurements," by D. H. Keeley, Ottawa.

A paper has been promised by J. J. Wright, Toronto, but the subject has not yet been announced.

The following special social features have been arranged.

September 17th, 8 P. M.—Members and ladies will be conveyed by special electric cars to view the Chaudiere Falls, the lumber mills, and electric power houses. This is a sight which for novelty and interest can scarcely be duplicated outside of Ottawa.

September 18th, 8 P. M.—Banquet to members and ladies at the Russell House.

September 19th.—Immediately after the adjournment electric cars will be provided to carry members and ladies over the Street Railway company's lines out to Rockliffe park and return.

It is anticipated that arrangements will be consummated for members and ladies to run the water slides on a raft of square timber.

His Excellency Lord Aberdeen has placed his electric launch at the disposal of members and ladies.

## Litigation of the Third-rail Patent.

The Siemens & Halske company of America has commenced an action against the Metropolitan Elevated Electric Railroad company of Chicago, for an injunction restraining it from using the third-rail system. The Siemens patent under which this action has been begun was granted August 11, 1885 (No. 324,176), and covers "an improvement in an electric railway," and an assignment of the patent was made August 5, 1891, to Siemens & Halske of Berlin, and May 22, 1894, by the latter to the Siemens & Halske company of America. The patent is attached to the bill, which states that notice was given President R. E. Jenkins of the Metropolitan "L" that the patent was being infringed, but that, notwithstanding, he authorized its use. A provisional injunction and an accounting are asked.

President Wright of the Siemens & Halske company of America is reported to have said:

"The Metropolitan 'L' had ample notice it was infringing the patent. It may be asked why did we not bring suit against the General Electric company when it operated the Intramural road at Jackson Park. The answer is simple; the road was run at a world's fair under the direct supervision of the government, and it was agreed should be dismantled in a certain time."

## Three-phase Railway Plant in Ireland.

There is at present under construction an electric railway installation of much interest at Dublin, which is being put in by the British Thomson Houston company. This line extends from the city of Dublin through Pembroke and Blackrock to Dalkey, the total length being approximately 8½ miles. Owing to the fact that the position of the power house had, for various reasons, to be fixed near the beginning of the line, and in order to decrease the cost of feeders and return circuit, it was decided, says the London *Electrical Review*, to feed the line near the station directly by continuous current, and to establish two sub-stations, one 3½ miles and the other eight miles from the power house, to which three-phase alternating current, at a pressure of 3,000 volts, should be transmitted. In each sub-station two 60 kilowatt rotary transformers transform the alternating current into continuous current at 500 volts, and feed the overhead line. The general installation was designed by H. F. Parshall, of the General Electric company of the United States, and technical adviser to the British Thomson-Houston company.

## Electric Power in Factories and Mills.[1]

By F. B. CROCKER, V. M. BENEDIKT AND A. F. ORMSBEE.

### INTRODUCTION.

The application of electric power distribution to the operation of factories and mills, including the driving of the various machines and other apparatus, is the latest and one of the most important problems toward which attention is now being directed, the question being one of extreme prominence both from an economical as well as from an engineering standpoint.

In comparing two or more different systems of power distribution, the fundamental basis of comparison is generally that of dollars and cents. This is certainly correct, as far as it goes, but unless a very decided difference be found between the costs of running under the various systems, it may be found that other factors enter—factors which cannot be estimated in dollars and cents, namely, questions of desirability and convenience. Without considering any tests whatever, there are several exceedingly advantageous points in the use of motors in factories which are almost self-evident, such as: (1) Clear and unobstructed passages and head room, the latter facilitating the use of traveling cranes. (2) Ease of shifting the tools from place to place, possibly necessitating the placing of a starting box and the putting up of a little extra wire, as compared with the inconvenience and trouble of setting up and adjusting a line of shafting, hangers, belts, etc. (3) The economy due to the ability to run a single tool without necessarily starting the whole factory, or at least a complete section. (4) The running expense is entirely stopped when the tool is shut down. (5) The absence of the drip of oil from overhead shafting. (6) The tools may be placed at any desired points, almost regardless of the distance. (7) It is not necessary to arrange the tools parallel as in the mechanical system. (8) A wider range of speed is possible. (9) Less damage caused by a fuse blowing than by a belt slipping off in case of accident or excessive load.

Considerations like these have great weight in deciding a question such as that under discussion, and there is no doubt whatever that in most cases they rise to such prominence that they warrant a complete change from the old system to the new, even though there is no gain in economy or increased output. In most cases, however, it has been conclusively shown that considerable saving and increase in production is obtained, one test showing a very considerable percentage of increase in the output. The partial, if not the complete, displacement of the old method by the new is only a question of time, and it was the appreciation of this fact that induced the authors to undertake the determination of the power actually required to run the various tools and machines as used in ordinary practice.

### HISTORICAL NOTES.

The subject is a comparatively new one, not dating back further than about 1890; hence the history of the subject is necessarily short. About five years ago motors were in operation in the works of the Thomson-Houston company at Lynn, the Crocker-Wheeler company and the C & C company. Shortly afterward the great German works of the Siemens & Halske company and the Allgemeine Elektricitäts Gesellshaft began using motors to operate sections of their factories. From that time to the present the use of motors has extended rapidly, until now they have been adopted in many factories all over this country, and to a less extent abroad.

### PRACTICAL TESTS.

In the tests which follow, the power required to drive the tools was obtained by placing an ammeter in the circuit of the motors running the various machines and groups of machines, and taking readings every few seconds, the frequency of the readings depending upon the nature of the tool and the work it was doing. The potential was practically constant at 110 volts, not varying more than 1 or 2 per cent. The first tests were made at the factory of the Crocker-Wheeler Electric company at Ampere, N. J., and the machines tested and the results obtained were as follows:

1. *Large Boring Machine.*—This machine was driven by a 1½ horse power motor, speed 1,200 revolutions per minute, mounted directly on the frame of the tool, the reduction in speed being obtained by the use of gearing. During this test, which lasted three hours, the machine was used for turning down a commutator for a 100 horse power dynamo. The average current drawn was 8 3 amperes, representing 1.23 horse power at 110 volts. Before the run was finished, the speed of the tool was increased by changing the combination of gears, and during this time the power required was 1.43 horse power. When the machine was started from rest, the rush of current was considerable, the average being 17.75 amperes, representing 2.6 horse power. It will be seen that this motor is well suited to the machine, the average load being very close to the rated power of the motor.

2. *Drill Press.*—A drill press was run by a one horse power motor, speed 545 revolutions per minute, mounted on a shelf at top of press and belted down to countershaft at bottom and thence up again to main shaft of machine, thus securing a reduction of the speed. This machine was boring the faces of the cast steel pole pieces of a 10 horse power motor, two cutting tools being used. The test lasted four hours and 40 minutes, and during this time the pole pieces for three motors were bored. The first run covered one hour and 10 minutes and the average current was 2.92 am-

1 Read at the twelfth general meeting of the American Institute of Electrical Engineers Niagara Falls N. Y., June 26, 1895

peres, representing .43 horse power. It required 15 minutes to replace the completed pole piece by another one. This second piece required two hours and 30 minutes to finish, and the average amperes was 2.82 or .41 horse power. This time it required 17 minutes to replace the piece and then the machine ran only 23 minutes until closing time. The current for this short run was 2.81. amperes, representing .41 horse power. The total length of time the machine was running was four hours and five minutes. Therefore power was supplied to the motor 86 per cent. of the time of the test.

3. *Drill Press.*—This machine was similar to the one preceding, but the work was different; namely, drilling half inch holes in cast-iron bearings. The average current was 2.86 amperes, which represents .42 horse power.

4. *Drill Press.*—This tool was the same as the other two and the work consisted in boring the inside of cast-iron bearings. The average in this case was 1.9 amperes, or .28 horse power. It will be noticed that in the case of these three machines a motor of ½ horse power would be of ample size to do the work.

5. *Punch Press.*—This was a small punch run by a one horse power motor mounted on the base of the machine and belted to its heavy flywheel. The speed of the motor was 700 revolutions per minute. This tool was punching slots in sheet-iron disks for a 10 horse power armature, there being 28 slots in each disk. The motor was turned off every time a disk was replaced, but it did not come to a dead stop, as the inertia of the flywheel was so great. Readings were taken every five seconds and the time of turning on and off the current was noted. The test lasted 57 minutes, during which time the current was turned on for 35 minutes and 45 seconds, or 62.7 per cent. of the time. The average current was 4.86 amperes, equivalent to .71 horse power. The rush of current at starting varied from 7 to 15 amperes, depending upon the haste of the workman in turning on the starting box.

6. *Gang Drill.*—This tool was driven by a one horse power motor, 1,000 revolutions per minute, mounted with vertical shaft in frame of the machine and belted directly to the three drill spindles. The material drilled was cast-iron and the sizes of the holes were one-quarter inch and three-eighth inch. The average of the readings taken was 4.75 amperes or .7 horse power. When the drills were running free the motor took 3.5 amperes. Thus the power required to overcome friction was 74 per cent. of the power used while drilling.

7. *Group of two machines, one lathe and one milling machine.*—This group was driven by a three horse power motor, belted to a short line shaft, from which belts ran to the countershafts above the two machines. The average current was 10.04 amperes, the power being 1.48 horse power. In this test special attention was paid as to which machine happened to be running free, cutting, etc., with the results given in the following table:

| Class of Machines and Work. | Amperes. | H. P. |
|---|---|---|
| Milling machine running free—lathe at rest | 5 67 | .836 |
| Lathe machine running free—miller at rest. | 7 36 | 1 085 |
| Both running free ... ..... ........... | 10. | 1 47 |
| Milling machine cutting lathe run free. | 10 33 | 1 52 |
| Lathe cutting—milling tool running free. | 14 42 | 2 12 |
| Both tools cutting ... .. .. . ......... | 15 4 | 2 28 |
| Cutting rate increased on the lathe........ | 17 8 | 2 61 |

8. *Group of Six Machines, Consisting of One Milling Machine (Small), Two Lathes (10 or 12 Inch Swing), One Grindstone, One Drill Press and One Small Punch Press.*—The last named tool was not run at all during the test and the grindstone ran continuously. This group was run by a one horse power motor, belted to the usual ceiling line shaft. The average current required to drive these machines was 5.86 amperes, representing .86 horse power. Thus this motor ran at about its most economical load.

9. *Group of Seven Machines, One Planer (Small), One Grindstone, Four Lathes, One Hand-turning Lathe.*—A three horse power motor was used to drive this group, being belted to a line shaft, the same as the previous groups. The current was 13.36 amperes, or 1.97 horse power. When the entire group was in use 2.65 horse power was required.

10. *Group of Seven Lathes and One Grindstone Driven by a Three Horse Power Motor.*—The average current was 9 92 amperes and the power required was therefore 1.46 horse power. The power used by the motor when different numbers of lathes were running is shown by the following table:

| Number of Lathes Running. | Amperes. | H. P. |
|---|---|---|
| One ............... ... . . ......... | 7 76 | 1 14 |
| Two ........... .. ..... ........ .... | 9 16 | 1 35 |
| Three . ... ... .......... ......... | 10 62 | 1 58 |
| Four.... ............ . ........... . | 12 23 | 1 8 |

Thus, in a group like this, it only takes 63 per cent. more power to drive four lathes than it does to run one, the reason being the fact that it probably takes about one horse power to drive the counter-shafts.

11. *Group of Two Machines, a Large Punch Press and a Large Planer.*—The motor for running this group was placed on the floor and drove a short line shaft on the ceiling by the usual form of belt. The rated capacity of this motor was 7½ horse power, and its speed was 1,350 revolutions per minute. The punch press did not run during the test. With the planer idle and the motor driving the shafting and belting alone, the current was 15.5 amperes, which represents 2.3 horse power. While the planer was at work the motor required 33.1 amperes or 4.87 horse power. As the loss from friction in the shafting is nearly constant under the variation of load, the power required to overcome this friction was 47 per cent. of the total power used. When the bed of the planer reversed from its slow cutting stroke to the comparatively rapid return stroke, the current increased to 52 amperes, showing an expenditure of 7.6 horse power for a few seconds. This tool was planing the frame of a 90 kilowatt multipolar dynamo, the material being cast-iron.

12. This group was a very large one, consisting of 20 machines—eight lathes, four milling machines, three planers and shapers, two grindstones, one vertical shaft grinding machine and three small tools. The motor in this case was rated at 10 horse power at 750 revolutions per minute. A Thomson recording wattmeter was placed in the circuit of this motor for one afternoon. At the end of this time the wattmeter showed a total of 17,854 watt-hours used, and as the time was five hours, the average power was 3,571 watts, or 4.78 horse power. The average number of machines running was 13, most of the lathes being in use the greater part of the time. An ammeter was inserted in the circuit of the motor for a few minutes and it was noted that the work was very steady, the current not varying more than three or four amperes at any time.

13. A group of five machines run by a three horse power motor was next tested. Of these five machines one was a lathe with 17 inches swing and eight feet bed, one was a slotter, and the other three were lathes of 12 or 14 inches swing. The average amperes were seven and the power 1.03 horse power.

14. The last tool tested at this factory was a large new engine lathe, which had just been set up, of 50 inch swing. This tool was driven by a three horse power motor mounted on an iron bracket built in the base of the machine. The motion of the motor shaft is transmitted to the tool by gears, thus doing away with all belts. The work done was turning a 5½ inch steel shaft for a 200 kilowatt dynamo, facing the ends, etc., the cut being very light, as the work was only preliminary. The average current consumption was 11.4 amperes. Hence the average power was 1.68 horse power.

The following tests were made in the erecting shop of the De La Vergne Refrigerating Machine company, at Port Morris, N. Y.

1. *Planer.*—A large planer, 120 inches between posts by 108 inches high, by 22 feet bed, was driven by a C & C motor of 15 horse power. The voltage employed was supposed to be 220, but due to an incorrect station voltmeter the actual potential only averaged 190 volts on the morning of this test. The average current was found to be 20.08 amperes, which at 190 volts represents 5.11 horse power. At the reversal from the cutting to the back stroke the current increased to 85 amperes, equivalent to 21.65 horse power. The power required during the cutting stroke was 4 76 horse power, while on the return stroke the average was 5.73 horse power.

2. *Drill Press.*—A drill press driven by a five horse power C & C motor was tested in the afternoon. The potential was raised before this test so that the average was 215 volts. The power required when drilling various size holes is shown in the following table:

| Size of Drill | Amperes. | Horse Power. |
|---|---|---|
| Running Free | 3. | .865 |
| ⅞ in. | 4 07 | 1.23 |
| 21/32 in. | 4.37 | 1 26 |
| 31/32 in. | 4.6 | 1.33 |

3. *Corliss Cylinder Boring Machine.*—This tool was driven by a 10 horse power C & C motor and was boring the brass boxes, 6¾ inches diameter, of the main shaft bearing of a large ice machine. The average current was 14.47 amperes, representing 4.17 horse power at 215 volts.

In order to place the results in a more convenient form the following table of average powers was compiled.

TESTS AT THE CROCKER-WHEELER FACTORY.

| No. of Test. | Size of Motor Horse Power | Number of tools driven by motor. | Average Amperes. | Average horse power. | Remarks. |
|---|---|---|---|---|---|
| 1 | 1 5 | 1 boring machine | 8 3 | 1.23 | |
| 2 | 1 | 1 drill press. | 2.85 | .42 | Less than ½ full load of motor. |
| 3 | 1. | 1 " " | 2 86 | .42 | |
| 4 | 1. | 1 " " | 1.9 | .28 | |
| 5 | 1 | 1 punch press. | 4.86 | .71 | |
| 6 | 1 | 1 gang drill. | 4.75 | .7 | Drilling ¼ in. and ⅜ in. holes. |
| 7 | 3. | 2 machines. | 10.04 | 1 48 | |
| 8 | 1 | 6 " | 5.86 | 1 86 | All small machines. |
| 9 | 3. | 7 " | 13.36 | 1 97 | |
| 10 | 3. | 8 " | 9.92 | 1.46 | |
| 11 | 7.5 | 2 " | 33 1 | 4.87 | Required 2 3 h. p. to run shafting only. |
| 12 | 10 | 20 " | | 4.78 | Tested by wattmeter. |
| 13 | 3 | 5 " | 7.0 | 1.03 | |
| 14 | 3 | 1 engine lathe. | 11 4 | 1.68 | Light cut taken by tool. |

TESTS AT THE DE LA VERGNE WORKS

| | | | | | |
|---|---|---|---|---|---|
| 1 | 15 | 1 planer. | 20.08 | 5.11 | Planer 10 in. x 9 in. x 22 in. Voltage 190. ⅞ in. drill. |
| 2 | 5 | 1 drill press. | 4 07 | 1 23 | Voltage 215. |
| 3 | 10. | 1 boring tool. | 14 47 | 4.17 | Voltage 215. |

The results obtained in these tests show that the power required to drive machine tools has been considerably overestimated, for it will be noted that with a large majority of the tools tested, the motor was not more than one-half loaded, and in these cases it was seldom that the load equaled the full power of the motor, even for an instant. In the case of the large planer, although the motor was overloaded 50 per cent. upon reversal of the bed, the average load was only one-third of the rated full load. With this machine, however, when the piece of work is very short, necessitating more rapid reversals, the average load will be much nearer the most economical output of the motor.

The question of running machine tools by individual motors or grouping a number of machines together and driving them by one motor does not seem to allow of a general solution. It would not be advisable, for example, to use the individual system where there are a number of small tools, each one of which requires only a small fraction of a horse power. On the other hand if we have a large tool that requires considerable power, it would seem to be far more economical to run it by a single motor, using as little belting and shafting as possible.

Many of the manufacturers of machinery are now supplying boring mills, punching presses, drill presses and other machine tools arranged to be driven by electric motors. In most cases all that is necessary is a shelf or bracket on the tool to support the motor and a gear wheel in place of the main pulley, unless a belt connection is preferable. A press or other tool having a large fly wheel may be driven very conveniently by cutting teeth on the edge of the wheel, which gear with a pinion on the motor shaft.

ELECTRIC POWER IN THE NEW ENGLAND COTTON MILLS.

The introduction of the electric system of distribution of power in the cotton industries of New England is now fairly begun. Although there are no large mills driven entirely by this system, a number of them have an electric plant and certain sections of the mill are driven by motors. An electric plant was installed four or five years ago in the works of the Silver Spring Bleaching & Dyeing company, at Providence, R. I., but it was intended chiefly for lighting. But motors were placed in the carpenter and repair shops, and several other places, until at present there are about 100 horse power of motors installed in eight units. The generating plant consists of three 100 horse power U. S. dynamos belted together from a countershaft which is driven by a Corliss engine. Two of the machines are 110 volt dynamos, which are used for lighting and running most of the motors at present. The third machine which has just been installed is a 500 volt Westinghouse power generator of the same type as the lighting machines. There is only one machine at present connected to the 500 volt circuit, a 30 horse power motor which drives a centrifugal pump supplying a storage reservoir with water for use in the bleacheries. The electric plant in this mill is not of much importance yet, but its chances for development are very bright, since there are a number of machines now run by individual steam engines. These could be most advantageously replaced by electric motors, as they are in some cases a great distance from the boilers, involving large losses from condensation.

A visit was made to the works of the Donnell Manufacturing company, at Pawtucket, R. I., where a very fine electric plant has very recently been installed to drive the calico printing machines. The problem of running this class of machinery by electric motors has been a very difficult one to solve, for the motor must be capable of running at a number of different speeds and running constantly at any given speed with a variable load. In this case it has been solved by the use of a modification of the Leonard system of motor regulation. The outfit for each printing machine consists of a motor and a dynamo of the same size, the field rheostat of the dynamo being placed alongside the printing machine. The speed of the motor is thus changed by varying the voltage of the particular dynamo which supplies it with currents.

The dynamo room contains 11 dynamos of the new moderate speed, four-pole type, made by the General Electric company. They are run by a Corliss engine through a system of belting and ceiling countershafting. Six of these are 20 kilowatt machines and four are 25 kilowatts. The eleventh dynamo is a similar 20 kilowatt machine used for exciting the fields of the other dynamos. The normal potential is 250 volts, and is lowered in any particular dynamo when slower speed of the motor connected to that circuit is desired. This plant has been completed but a short time, and it was not possible to obtain any accurate figures showing the power used by the motors under various conditions of speed and load. Formerly the machines were run by individual engines and much difficulty was experienced in starting them, as the pressure of the printing rolls against the cloth is so great. With electric motors this difficulty is overcome, as the motors will stand a very heavy overload for a short time, and the starting torque is very great. The great advantage of the electric system as here used is not so much in the saving of power as in the convenience to the workmen, and hence the increased production.

The saving of power, however, is quite considerable, as in the old system steam was piped several hundred feet to the small individual engines, which were necessarily inefficient under the best conditions, and added to this the engines were run part of the time with partly closed throttle, still further decreasing the efficiency. With the present system the attendant at the machine may quickly vary the speed any amount by turning the rheostat near the machine.

Although this plant has been in operation only a short time, it is claimed by those in control that the production is materially increased. In a paper by S. B. Paine in *Power*, June, 1895, he states that the increase in the production amounted to more than 25 per cent. and that the quantity of "seconds" (inferior product) was also considerably reduced.

This is very important, as the men in charge of the printing machines are skilled workmen of the higher order and a small saving in wages for a given production is of more value than a considerable saving of power.

A visit to Baltic and Taftville was also made to see the practical working of the well-known power transmission plant between these places. At Taftville, where the Ponemah mills are located, there is not sufficient water power to drive all the machinery, so an electric plant was installed at Baltic, 4½ miles up the river, where a dam had been built, giving an available head of 34 feet. The wheels are horizontal balanced turbines, two of them being rated at 800 horse power each, while the third one is rated at 300 horse power. The wheels are belted to a long line shaft, which is in turn belted to the dynamos. The generators, of which there are two, are placed in a separate room. They are of the three-phase General Electric type and are capable of supplying 250 kilowatts at 2,400 volts. They have 10 poles and run at 600 revolutions per minute, giving a frequency of 50 cycles per second. The field is excited by a three kilowatt

bipolar dynamo belted from the generator shaft. The power is transmitted to Taftville by a very well constructed pole line. The motors are located in the basement of the Ponemah mill near the engines which they replace. They are belted to pulleys, which are connected to their respective shafts by friction clutches in order to enable the motors to be started without load, as they are of the synchronous type. The motors are identical with the dynamos except in having an induction winding of heavy bars sunk in the pole pieces, to cause them to be self starting. In starting the motors, the switch in the induction circuit is closed and then the line is connected to the armature, causing it to start as an induction motor, without a very great torque, however. When the motor has nearly reached full speed the field is excited and it will speed up until it falls into step and then the induction switch is opened. This method of starting has two advantages: First, no auxiliary motor is needed; second, no device is required to tell when the motor is in synchronism with the generator.

One of these motors drives 1,200 looms requiring an expenditure of about 155 horse power. The other drives 500 looms and also the railway generators for the Norwich Electric Railway company. The introduction of this plant has enabled the company to concentrate all its power for use in one mill, tending to decrease the cost of production, diminishing transportation charges and avoiding the use of any coal for steam power.

CONCLUSIONS.

*First Cost.*—Practically the only objection which can be urged against the electric system is the fact that the first cost of installation is greater than with ordinary belting and shafting, but even this is questionable since the authors know of cases in which the estimated total cost of installing the necessary belting and shafting was actually greater than the equivalent electric motor outfit. The electric system would be cheaper, for example, in the case of very long or scattered buildings or those containing many stories or rooms, in any of which cases the belting and shafting required would be very complicated and expensive. The use of belting and shafting requires a much stronger and more expensive roof or ceiling than the electric system.

*Saving of Power.*—It might seem that the electric system would actually consume more power than the ordinary plan, since it involves two transformations of energy. In most cases, however, if the power has to be distributed to a number of machines, particularly if they are located at any distance from the engine, the loss of power is less with electric transmission. This is explained by the high efficiency of the dynamo and motor compared with the low efficiency of belt transmission as ordinarily practiced, involving as it often does very imperfect alignment and lubrication of the shafting. Perhaps the greatest saving, however, of the electric system is due to the fact that the consumption of energy entirely ceases when the tool stops. This stoppage in the case of the busiest tools amounts to at least 25 per cent. of the nominal working hours throughout the year, and with large or special tools which are not used so steadily the stoppage is often as high as 50 to 75 per cent., since there are many whole days when they are not used at all.

Idleness due to strikes as well as to slack times must also be considered and would usually amount to quite a large percentage in ten years for example. This assumes, of course, that a portion of the shop is running, which is usually the case even under such conditions. In short, with the mechanical system there is an enormous amount of shafting, idle pulleys and belting which runs for long periods of time doing little or no useful work, but consuming considerable power.

Wherever electric motors can be substituted for a number of small engines scattered about, the saving in power is very great, not only because of the low efficiency of small steam engines, but also by the avoidance of condensation in long steam pipes.

*Increased Output.*—This is, perhaps, the most important advantage gained by the electric system, since after all the cost of power is a very small item, being, according to Mr. Richmond[1], only about 1 per cent. of the wages paid in average machine shop practice.

This increased output is secured by the greater convenience and promptness in starting and stopping as well as in regulating the speed of the machinery. The workman can, for example, temporarily increase the speed when the conditions are favorable, thereby saving considerable time.

*Flexibility.*—The great convenience of moving the tools and placing them in any desired position is another great advantage of the new system. The great adaptability of this system is particularly well shown in the case of a factory which was almost completely destroyed by fire; nevertheless a few uninjured tools in a remote end of the building were operated successfully by means of electric motors within two days after the fire.

*Speed Regulation.*—The ordinary type of motor used in factories is the plain shunt wound machine fed with constant potential current. The motor is started and varied in speed by means of a rheostat in the armature circuit. This simple arrangement answers very well in most cases, but for variable speed between wide limits a series wound motor controlled by a rheostat, as in electric railway practice, may be preferable. In other cases some special method of regulation, such as the Leonard system or the "boost and retard" plan may be adopted.

In concluding, the authors wish to express their sincerest thanks to the various companies for the courtesy shown by them and for the kind assistance which they rendered during the tests.

1. *Engineering Magazine*, January, 1895.

## Trolley Party in Chicago.

The form of entertainment known as the "trolley party has been introduced in Chicago. On Tuesday of last week over 100 young people from West Pullman, Pullman, Kensington and Roseland chartered four electric cars and took a jaunt over the Calumet electric system. The party left West Pullman and went to Seventy-second street and Cottage Grove avenue; thence to Auburn Park, to Sixty-fourth and Stony Island avenue, to South Chicago, Burnside and back again to West Pullman. The train was gayly decorated with bunting, and nearly every member of the party was armed with a foghorn or whistle. The Roseland orchestra occupied seats at the head of the train. Several individuals at various points tried to stop the train, and some succeeded in getting aboard. No amount of argument could convince them they were intruding upon a private party, and they had to be forcibly ejected. A. E. Davies, assistant superintendent of the Calumet system, was in charge of the party.

## Acetylene and Its Production.[1]

BY FRED. M. ROUNDS.

Acetylene may be stored in liquid form at a temperature of 1° C., under a pressure of 725 pounds per square inch. When liquefied and sprayed, it forms into a whitish vapor which burns with a clear flame having a temperature of 1,000° C., that of ordinary gas being 1,360° C. It is soluble, volume for volume, in water, and is convertible into benzine, aniline, ethylene, alcohol and other useful products. If stored in liquid form, the gas is especially adapted for isolated lighting, such as country hotels, buoys, and railway cars. When burned in a suitable jet at a rate of 0.5 cubic feet per hour, a single rod weighing a pound will give a light of over 20 candle power for about 10 hours. Mixed with an equal volume of air before being burned, the diluting action of the nitrogen reduces the illuminating value from 240 to 130 candle power.

The furnace in which the calcium carbide is produced does not differ materially from the ordinary electric furnace. The upper electrode is movable and may be lowered into a carbon crucible which serves as the other electrode.

To produce 2,000 pounds of the carbide, 1,200 pounds of fine coal-dust and 2,000 pounds of burnt lime are needed; the current being from 4,000 to 5,000 amperes, with a total of 180 electrical horse power for 12 hours.

The cost where there is cheap water power, coal, lime, etc., is about $15 per ton. In fact, the success of this process depends chiefly upon cheap water power, for only 5 per cent. of the heat produced by coal is recoverable in an electric furnace.

One ton of calcium carbide will produce about 10,500 cubic feet of acetylene, which would be equal in illumination to about 100,000 cubic feet of ordinary city gas of from 22 to 25 candle power per five foot burner.

It is stated that one horse power of electrical energy, if consumed in incandescent lighting, would give light equal to 1 as compared with 1.57 if consumed in the production of the acetylene light. Central station men claim that this would not be a sufficient difference to make it possible for the acetylene light to compete with the electric light, as the cost of storing, packing and selling would diminish this difference materially.

Furthermore, the price quoted for calcium carbide, $12 per ton, rests upon a cost of only $5 per yearly electrical horse power, while the price of power generated at Niagara is placed at $18 for the same amount, and this price is at the generator terminals.

The brilliancy of the acetylene flame is more than counterbalanced by the lack of sanitary advantages which are found in the incandescent electric lamp. It consumes the oxygen in the air and gives off smoke and carbonic acid.

The Welsbach burner has not materially affected the electric light, and since acetylene, for the same illumination, would have to be sold at about half the price of ordinary gas, it is scarcely probable that the electric light will find an active rival in it.

If, however, there should be a demand for this light, there would also be an additional demand for power, and should it prove to be a serious rival of the electric light it undoubtedly would be profitable for central stations to undertake its manufacture and thus obtain the much needed and long desired day load.

1. Abstract from the *Year Book of the Society of Engineers.*

## Dr. Herz's Latest Invention.

In an interview with a representative of the *Pall Mall Gazette*, Dr. C. Herz recently announced that he had invented and completed a system of electrical transmission which would permit of telegraphing more than a hundred thousand words across a submarine cable where now only 20 are sent in the same time. "It is," said he, "an accomplished fact, and capable of being applied to-morrow to any instrument in existence. My experiments were made years ago, before my arrival in England, and before my illness. I have had at my disposal all the telegraph lines in France during the night, and at other times during the day when they were not occupied. I wait only for the opinion of a well-known patent attorney, when the world will know the details."

The invention, the journal explains, will permit of such a quantity of matter being forwarded at the very last moment from the uttermost parts of the earth that four daily editions of the sheet which possessed the franchise could be issued and monopolize the newspaper business. And still greater marvel, he says, it will allow of working the telephone in multiple across the ocean.

*L'Industrie Electrique* is skeptical, and pronounces the inventor the "Irreducible" and the "Moribund of Bournemouth," and it describes the interview as a "chef-d'œuvre of boasting, claims and lies," and adds: "Such audacity, such lack of conscience, disarms one. *L'Industrie Electrique* is not a journal of polemics, and hence abstains from analyzing the coarse absurdities, the contradictions and the falsehoods with which the interview overflows, being content to deliver the text for the public to judge."

## American Institute of Electrical Engineers.

The first meeting of the season will be held by the American Institute of Electrical Engineers at New York on September 25th, instead of the 18th, and the council meeting has also been postponed to the later date. The feature of the meeting will be the reading and discussion of a paper by Charles S. Bradley on "Phasing Transformers."

# CORRESPONDENCE.

## New York Notes.

NEW YORK, September 7.—An interesting feature of to-day's international yacht race was the means adopted by the Commercial Cable company and the Postal Telegraph-cable company to secure the quickest possible transmission of bulletins. The messages were sent directly from the course on the water, a temporary cable connecting the cable-laying steamer Mackay-Bennett with the mainland, and thus with the waiting public in America and Europe. On Thursday the steamer arrived at New York for the purpose of laying the submarine cable to report the news of the yacht races. On account of the fog that prevailed on Thursday morning the laying of the cable was delayed from eight o'clock to noon. Then the steam lighter, J. S. T. Stranahan, came alongside the Mackay-Bennett and took on board about a half mile of cable. The lighter approached within a few rods of the shore, and sending out a cable cutter, manned by seven men, a rope was cast ashore to the men in charge of the cable house. In this fashion the end of the cable aboard the Stranahan was connected with the end of the transatlantic cable of the Commercial Cable company in the cable house. The steam lighter then rapidly paid out the cable line until it reached the Mackay-Bennett, where the end of the line was taken aboard and spliced. Fourteen miles of cable was coiled in one of the receiving tanks of the Mackay Bennett. Under the directions of Captain E. G. Schenk the cable steamer started on its journey to Sandy Hook, paying out the cable, which is 1¼ inches in diameter. By 11 P. M. the Mackay-Bennett had reached a distance midway between the Scotland and Sandy Hook lightships. Here the cable was buoyed, to be picked up on the first day of the races. As soon as it was learned from the yachting committee where the start was to be made the cable was paid out to a position of advantage, while the Mackay-Bennett lay by. The ends of the cable were again spliced and connected with the telegraph instruments on the steamer. Here a force of telegraph operators flashed the result of the race across to London simultaneously with the firing of the gun that announced the winner. The lookout, seated on the cross-piece, announced the progress of the race to the operators on the deck below. By an ingenious arrangement the cable was slipped from time to time, and the boat moved to suit the conditions of the contest between the yachts. The bulletins of next week's races will be cabled in the same manner.

The *Sun* gets the news of some curious effects of lightning discharges. It reports that a man started to swim to shore from a capsized boat off Greenwich Point, taking his nine-year-old son on his back. He struck out during the storm; then a vivid flash of lightning came, and when they looked again, at another flash, the man and boy were not visible. The bodies were found floating near the beach. Doctors and men on shore tried until near midnight to resuscitate them, but without avail. Marks on the man's breast led to the belief that he was struck by lightning. He was a good swimmer and could wade ashore within 200 feet of the boat. More remarkable still is this story, purporting to come from West Orange, N. J.: "On Saturday afternoon Mr. Lewis left his home to go to Newark, and told his wife that business might detain him. Mrs. Lewis decided to prepare the evening meal for Mr. Lewis, but not to cook it until he came home. She went so far as to put the coal and wood in the stove and put the dinner on it, but she did not light the fire. During the thunderstorm a bolt of lightning struck Lewis' house. Mrs. Lewis became so alarmed that she fled with her two children to a neighbor's house. Mr. Lewis found her there on his return, and she refused to go home that night. In the morning Lewis and his wife found the dinner still on the stove, but thoroughly cooked, and the wood and coal burned out. Investigation showed that the lightning had struck the chimney on the house and had divided, one part going down the chimney and the other down the outside of the building. Mr. Lewis ate the dinner for breakfast, and declared that it was all right."

The *Herald* prints some interesting news in relation to the Rapid Transit Commissioners' proposed tunnel system,

[illegible] Engineer Parsons. One of the most [illegible] nted the engineers was the disposal of the electric wires, or, in other words, the system of [illegible] which extend along Broadway. Mr. Parsons received all the necessary aid from the electrical companies as he did from all the corporations interested in underground New York, but the problem was an exceedingly difficult one to solve, and took a deal of time to do it, but it has been done, it is thought, now, and done so well that all difficulties are said to have been overcome. Mr. Parsons, in speaking of the general impression that the tunnel will be poorly ventilated, and that the passengers in the trains will be half suffocated, said that all fear in regard to this matter should be dismissed at once. The motive power will be electricity. The elevated roads in Chicago and the underground system in Baltimore have more than demonstrated the feasibility of this plan without having to go to the other side of the Altantic to find the admirable results of the Greathead system. The trains are expected to ventilate themselves as they pass through the tunnel. They will pump fresh air in and the foul air out by their motion. Thus far no proposals have been submitted by the electrical companies for the right to use their systems. This is due primarily, of course, to the fact that the syndicate which will even ually construct the roads is yet in an extremely nebulous condition. Once, however, the syndicate is organized there will be no delay in securing all the plans and bids that are required. It is interesting to record that while the estimates for the rapid transit roads are placed at an aggregate of $50,000,000, at least $6,000,000 of this will be expended in laying the pipes and conduits to accommodate the network of pipes and wires that make a spider web of the lower part of the city. The *Sun* is still hammering away at the tunnel project. It professes to see in the Lenox avenue conduit trolley line evidence that "private enterprise will supply the people with all needed facilities for transportation in the upper air, and the possibility of making a subterranean road successful, as a financial enterprise will become absolutely hopeless. Of course," it adds, "cars passing above ground almost continuously will destroy the chances of profit of an underground road running trains at comparatively long intervals. If people can travel comfortably on the surface of the earth, they will not go down into a tunnel to get transportation."

W. F. O.

## Buffalo and Niagara Falls.

BUFFALO, September 6.—On the morning of August 26th the electrical power of the great plant at the Falls was for the first time turned on for commercial purposes, when the works of the Pittsburg Reduction company were supplied with current. The official turning on of the current was in the presence of the officers of the Cataract Construction company and affiliated concerns, the officers of the Pittsburg Reduction company and the electrical experts. No one not connected with one or the other of these concerns was admitted into either the power house or the reduction works. The power was supplied by the second dynamo, but exactly how much was transmitted cannot be said. Three of the monster rotary converters in the Pittsburg works were in operation. Each of these has a diameter of 13½ feet, and each has a capacity of 500 horse power. Everything worked satisfactorily and smoothly, and not a hitch of any kind occurred. The present capacity of the aluminum works is about 5,000 pounds a day, but this will be increased as rapidly as more pots can be set in position, until 10,000 pounds of the pure metal, worth in small quantities 50 cents per pound, is being turned out daily. The extensive works of the company at Kensington, near Pittsburg, have a greater capacity than this, but the officials of the company are so well satisfied with the workings of the Niagara Falls plant that future extensions will be made at this point, rather than at Pittsburg, where the rolling and foundry mills of the company are located. "We believe," said Capt. Hunt to a Buffalo reporter, "that we will be much better off here than at Pittsburg. Aside from the splendid shipping facilities afforded here, we know that the power actually costs us less than at our Kensington works, although we are in the heart of the soft coal district of Pennsylvania, and our coal costs us but 65 cents a ton delivered at the factory. We do not manufacture articles of aluminum; we simply sell the ingots, sheets or bars of the metal to the manufacturers of the cooking utensils and other articles that are made from them."

Now that the power has been turned on at the great cataract plant, the question that becomes of vital importance to the residents of the Tonawandas and Buffalo is how the current is to be transmitted from the Falls to Buffalo. Two routes have been laid out, one across to Grand Island and then across the river to Buffalo, the other through Tonawanda, close to the Central Railroad tracks. It has not been announced that either of these routes will be chosen. Now another report comes, and it is so reasonable that it is generally thought that it may prove to be true. It is that both the routes heretofore talked of are to be cast aside and the line of transmission is to be alongside the Ely electric line between the Falls and Buffalo. This rumor seems to be well founded.

The Niagara Falls Power company has declined to accept the franchise offered it by the joint committee of Buffalo councilmen and aldermen. In a letter Mr. Rankine states the company's objections as follows:

First—The second clause is objectionable, as it requires the company not only to construct, but also to maintain, during the life of the franchise, poles and conduits furnishing accommodations sufficient for at least two other companies with requirements equal to its own. That is, while in ordinary course the Power company would provide a line or conduit only twice the size required for its own first use, it would, under the proposed franchise, have to provide and maintain accommodations six times as large as required for its own special use.

The company would be willing to accept the provision requiring it to erect poles of a capacity sufficient for one other company and for the city's free use and to lay for its mains (though not for its lateral lines) conduits with a capacity sufficient for the city's free use and for the use of one other company requiring as great facilities and making use thereof within five years from construction upon payment of a proportionate part of the cost thereof, including interest, the Niagara Falls Power company to have the sole right of use of any line not so used and paid for within the stated period of five years, it being understood that similar conditions in favor of the Niagara Falls Power company would be annexed to any such grant to any other company.

Second—The sixth clause is also objectionable, as it requires that all wires strung under the grant shall be placed underground, and the poles shall be removed in such reasonable time as the Board of Public Works, with the approval of the Common Council, may require.

The requirement in this form would prohibit the construction of any lines, for they might be ordered down immediately after erection. The company thinks that all rights would be sufficiently protected by the condition that it should remove any such line on one year's notice.

Third—The ninth clause is objectionable in that it dates from the acceptance of the franchise an annual tax of 5 per cent. upon the gross receipts of the company. The probable cost of the first installation and of the successful introduction of power in Buffalo is so great that the company would be unable to accept such a provision or tax upon its gross receipts, or any provision for a tax of lesser percentage upon such receipts unless either (1) the tax be remitted for the first five years of the franchise, or (2) the tax be limited to all power delivered after the first 10,000 horse power. The modification of this clause involves a corresponding modification of the twelfth clause.

Fourth—The eleventh clause, limiting the grant to a period of 25 years, is impossible of acceptance for the reason distinctly set forth in the company's statement of February last. No franchise could be accepted for a period of less than 36 years—the term of the company's bond.

Fifth—The fourteenth clause, reserving to the Board of Public Works or to the Common Council the right to revoke and annul the grant on 10 days' notice for any alleged violation or failure to comply with any of its provisions, would forbid the investment of capital upon a franchise containing such provision, and is therefore unacceptable.

Henry C. Howard, president of the Bank of Niagara, named as one of the incorporators of the Lewiston & Youngstown railroad, which was incorporated with the secretary of state on August 29th, says that nothing further than the filing of the papers has been done as yet. "The securing of the charter was the first step," said Mr. Howard. "Surveys will be commenced very soon, and it is the intention of the company to build the road as soon as possible. We shall use the trolley system and build the road a short distance back from the river. Although no right of way has yet been secured, the road will run over private property, and we feel that we will not meet with opposition. The opposition to the proposed road of a year ago was because it was proposed to construct it in the highway. Our plans will not meet with any such objections."

The new Hamburg electric railway will be in operation as far as Blasdell by September 20th. The dynamos for the plant have arrived, and the iron is on the ground. From Blasdell the work of construction will be hurried along as fast as possible, and by next spring it is hoped to have the line completed as far as Hamburg. The new line begins at West Seneca, where it connects with the Bailey avenue line and extends through Blasdell to Woodlawn Beach, and thence to Hamburg.

The Niagara Falls Hydraulic Power & Manufacturing company has just let the contract for its turbines to John Leffel, Springfield, O. The total capacity of the three wheels will be about 5,000 horse power. As it is well known, a power station is to be built in the gorge near the Cliff Paper Mills and the work of clearing away the debris for the foundation has commenced. F. C. P.

## Washington, D. C.

WASHINGTON, September 6.—The American Bell Telephone company contemplates building a long-distance line from Washington to Atlanta, connecting with the Southern Bell Telephone company.

The Bureau of American Republics reports that a concession for the purpose of bringing electrical power into the City of Mexico has been granted to Arnaldo Yaquie, representing a syndicate of French capitalists. The water power for operating the machinery will be obtained from the river Necaza, in the state of Pueblo. The concession stipulates that a maximum energy of 8,000 horse power shall be supplied within five years from the date of the approval of the plans by the Department of Fomento, of which 3,000 horse power shall be obtained within two and a half years. The terms of the concession require that the work shall be commenced within six months after approval of the plans by the Department of Fomento, and the electrical current may be conducted by underground conduits or by overhead wires. Free importation of machinery and exemption from all federal taxes, except the stamp tax, is granted.

The New York Electric Equipment company has the contract for electric lighting in the Lafayette Square theater. The wires are all in place and the lamps already on hand. The theater is announced to open on September 23d, and the contract calls for the completion of all work before that time.

Permit was ordered to be issued to the United States Electrical Light company to replace the poles on Thirteenth-and-a-Half street, on condition that the company first place in the present conduit on that street the wires used for light purposes and all others to the extent of the conduit to accommodate them.

The Washington & Great Falls Electric Railway company has filed a deed of trust to the National Safe Deposit Savings and Trust company of the District of Columbia, as trustee, to secure $1,300 coupon bonds, aggregating $500,000, payable in 10, 20, and 30 years, with interest at 6 per cent., payable semi-annually. The property conveyed consists of the entire line of railroad, equipments, franchises and real estate of the railroad company. The purpose of the issue is to provide for the completion and equipment of the road.

Ratcliffe, Sutton & Co., auctioneers, offered at public sale last week the property of the Potomac Light & Power company in front of the power house near the south end of the Chain bridge in Virginia. The land, comprising some 10 acres, as well as the improvements and other property of the company purchased at the judicial sale of the property about a year ago by Amherst H. Wilder, was offered for sale. The highest bid received was $10,000, and the property was withdrawn.

A rumor is on the streets that the New York Central Railroad company owns a controlling interest in the Mount Vernon electric railroad. It is also said that a deed to this effect was recorded at Fairfax Court House last week.

W.

## ELECTRIC RAILWAYS.

The Columbia County, N. Y., Electric Railway company has been incorporated with a capital of $400,000, to operate a street surface railway between Hudson, Philmont and Stockport. Hiram McGonegal is at the head of the enterprise.

It is said that there is a good prospect of the construction of the proposed down-town elevated railway loop in Chicago. The company is now said to lack but few of the desired number of signatures of property owners. When the loop is built the cars upon it will undoubtedly be operated by electrical power.

A party of boys conceived the idea of making a swing by throwing a wire over the trolley wire in Paulina street, Chicago. Edward Rabbitt succeeded in placing the wire in the desired position. The next instant he fell to the ground unconscious, but still holding to the "live" wire. Some workmen near by released the wire from his hands and carried the boy to his home. Physicians who were called said that his recovery was doubtful.

The Mahoning Valley Electric Railway company, which is building an electric line from Youngstown, Ohio, to Niles, announces that the line will likely be put in operation by the middle of September. Arrangements have been made with the Youngstown Street Railway company, whose line runs straight through the city from Haselton to Brier Hill, to connect the two lines at that point. When the line from Girard to Niles is finished there will be one straight track about 16 miles long.

A charter has been granted the Dunmore Electric Street Railway company to build a street railway that will be a competing line between Dunmore and Carbondale, Pa., and between Scranton and Carbondale. It will extend from Dunmore through Carbondale to the line between Carbondale and Fell township. The capital of the company is said to be $75,000, divided into 1,500 shares of the value of $50 each. The charter is for 99 years and it includes about ten miles of streets in the borough of Dunmore. P. J. Horan of Dunmore, is president of the company and the other incorporators are I. H. Burns, E. J. Lynott, T. E. Boland and M. J. Sweeney.

A funeral procession of trolley cars attracted attention along the line of the Calumet & South Chicago road a few days ago. The route was from West Pullman to Oakwoods cemetery. The cars were appropriately draped; the casket was placed in the fore end of the first car and the friends seated themselves in the rear. This new style of funeral service created some comment at first, but the great distance of West Pullman from Oakwoods and the simple

convenience of the plan could not be overcome. The idea is endorsed, and a West Pullman undertaker is considering the proposition of petitioning for an entrance to Oakwoods cemetery convenient to the Calumet trolley line.

The Holmesburg, Tacony and Frankford (Philadelphia) electric railway is about ready for operation. Already the company has received applications for trolley parties. Fourteen summer cars and the same number of winter cars have been received from the American Car company, St. Louis. The winter cars have 18½ feet bodies, plate-glass windows and the platforms are vestibuled. The traffic arrangement which the company has with the Electric Traction company enables the following rates of fare to be made: From any part of Philadelphia to Holmesburg or the city line at Poquessing creek, 13 cents; from Holmesburg or the city line to the 5 cents fare limit on the Second and Third and Fifth and Sixth streets lines, 8 cents.

The Cicero & Proviso Electric Street Railway company is putting down a double-track line in West Lake street from Harlem avenue west to Maywood. Work on the trestle over the Desplaines river will be begun in a few days. It is designed to complete the line and put it in operation before cold weather. The company also has begun the construction of a line in Ogden avenue, which will be completed this year. All of the present tracks of this company are in the territory north of Madison street, but it holds franchises for occupancy of numerous streets south of that thoroughfare. It is the intention of the company to devote its attention to this southwestern territory, and to build new lines as rapidly as possible.

Philadelphians have two amusements now, remarks a New York contemporary. One is the trolley party and the other is the Zoological Garden at Fairmount Park. The greater of these is the trolley party. This may be because trolley cars are swift. They provide an absolute change from the ordinary life of the town. Beer and brass bands accompany trolley parties. When a steep down grade is encountered the conductor shouts, "Three minutes in the tunnel!" Then he pulls down the trolley pole. The lights go out. The motorman lets go the brakes, and the car shoots down the hill at a mile-a-minute gait. The darkness enables the young men to steal kisses unseen. The rides down hill are called "shooting the chutes." There have been no accidents yet, but there will be some day.

The Pittsburg & Birmingham Traction company is to have a new and valuable feeder in the Knoxville, Fair Haven & Mt. Lebanon railway, which is to be five miles long and cost $150,000, and be operated by the first named corporation. The new line is to be double tracked and will come into Pittsburg over Brownsville avenue, avoiding the necessity of using an inclined plane. The new company was incorporated in July, 1894, by J. F. Grimes, president of the Knoxville Land Improvement company, W. W. Murray, Henry Mueschke, Attorney A. N. Hunter and others. J. F. Grimes was elected president and W. W. Murray treasurer, and it was intended at that time to construct a single track electric road. The Birmingham company's extensions into that territory, and the lack of a suitable city terminus, caused the officials of the proposed road to negotiate with the Birmingham Traction company for some traffic arrangement.

## MISCELLANEOUS.

The specifications for the electrical fixtures for the new St. Charles Hotel in New Orleans are out, and bids must be in by September 16th.

The Treasury Department, through the office of the supervising architect, is inviting proposals until September 20th for furnishing and erecting, complete, an electric elevator for passenger service at the United States court house and postoffice building at Paris, Tex. Bidders may secure further particulars from Hon. H. R. P. Hamilton, acting supervising architect, Treasury Department, Washington, D. C.

A 25 horse power motor has been placed in the plant of the Malleable Iron Works of Smith's Falls, Can., to drive a blast fan for the furnace. A local paper says: "There is nothing about it that the *Record* can describe further than to say that it appears to be mechanism brought to perfection. Two small wires run into the top of the building and down to the large black machine on the floor. In this is stored the wonderful power that, touched by the wires, make the big pulleys on the shafting spin like tops, and drives an 18 horse power blower as if it were a toy."

The Moline, Ill., correspondent of the *Chicago Record* says that the East Moline company, while boring an artesian well, at a depth of 980 feet struck a stream of pure water which possesses remarkable magnetic properties. The pipes and drills are so strongly charged that quantities of nails are easily held in suspension from them. The waters are thought to possess medicinal qualities, and samples will be sent to Chicago for chemical analysis. The depth of the well has been increased to 1,140 feet, and as the flow is increasing the well will be deepened still farther.

Work on the electric fountain in the grand basin at the Cotton States and International Exposition has been completed, and during the past few days millions of gallons of clear water have been pouring into the lake from the city mains. It is filling rapidly and will soon be up to the level of the boathouses from which the electric launches are to make their trips. The fountain will be one of the most beautiful sights on the grounds, and at night, when its jets, sprays and fog banks are aglow with the colored lights that will flash from below, it will be one of the most gorgeous scenic illuminations ever produced.

The American Powder company at South Acton, Mass., has decided to build a three-phase power plant, consisting of two 75 kilowatt 550 volt generators, and eight 20 horse power, one 10 horse power and three five horse power induction motors all wound for similar voltage. The generators are to be driven by a combination of steam and water power, water wheels driving from 100 to 150 horse power and an engine supplying whatever may be required in excess of the capacity of the wheels up to 150 or 200 horse power. The motors will be placed at distances of about 800 feet to 2,600 feet from the generators, the line being practically continuous in one direction. The majority will be placed in a group at about 800 to 1,200 feet from the generator, the rest of the motors being extended along the line to the maximum distance. The motors will be housed in small brick buildings adjacent to each powder mill, there being in no case more than one motor to a mill. These mills are all quite small, as each step in the powder-making process is carried on in a different mill. The main shafting of each mill extends outside the mill proper and to this shafting the motors will be belted, running at an average speed of 110 to 120 revolutions. It will thus be seen that there is no motion in any mill except that necessary for the manufacture of powder. The equipment of these mills is directly due to the success which has attended the operation of two other mills of this company located in the West, which are operated by continuous motors and generators.

## TRADE NEWS.

The Mason Electric Equipment company, 307 Dearborn street, Chicago, carries a full line of the Medbery overhead material for electric railways, and prompt shipments are made from Chicago stock.

The firm of Morris & MacCurdy of Indianapolis has been reorganized, and is now MacCurdy & Smith, D. D. Smith having purchased E. P. Morris' interest. A successful business in the line of electrical supplies and construction is looked for.

Huebel & Manger, Brooklyn, N. Y., are having a big run on their high grade bells, etc., and are pleased to note that as business revives the market is more inclined to demand a good article. This is very encouraging, for their goods are noted for superior qualities.

The Barden-Sheets Electrical Construction company of Houston, Tex., has taken the agency for the Boudreaux dynamo brush for Texas, Indian Territory, Arkansas and New Mexico. J. W. Brooks of San Francisco reports a very good business on the Pacific Coast, where this specialty has met with legitimate success.

The Chicago Board of Trade has just closed a contract with the Pumpelly-Sorley Storage Battery company of Chicago for sixty 1,600 ampere-hour cells for the new plant in its building. It is rumored that prominent Chicago bankers have recently become interested in the Pumpelly-Sorley company, which will enable that company to greatly extend its field of operation.

The Western Telephone Construction company shipped a 400 telephone exchange equipment to Bloomington, Ill., last week, and during this week shipped a 400 complete telephone exchange outfit to Lansing, Mich., as well as a 100 telephone exchange equipment for Effingham, Ill. The same company has supplied the Metropolitan Elevated Railroad, Chicago, with a very fine switchboard and telephone equipment, which is now in satisfactory operation, connecting the various stations on the system.

Charles D. Mosher, of No. 1 Broadway, New York, proprietor of the Mosher patent water-tube boilers, has recently completed arrangements whereby Lewis Nixon, well-known among naval architects and ex-constructor for the United States Navy, will become associated with him in business. Their works will be situated on Staten Island Sound, where they have completed arrangements for railroad connections and many other advantages for ship building work. The address will be the Crescent Shipyard.

The Siemens & Halske Electric company of America has completed its first locomotive. As is well known, that company purchased the plant of the Grant Locomotive Works, at Chicago, after the failure of the latter company, and the engine just completed is one of 55 ordered from the Grant company by the Chicago, Burlington & Quincy. Twenty of these locomotives will be completed. The original design has been adhered to, and the locomotive is a ten-wheeler, adapted to either freight or passenger service.

The Electric Storage Battery company of Philadelphia (chloride accumulator) has acquired a controlling interest in the Eastern Electric Light & Storage Battery company of Lowell, Mass., the manufacturer of the Sorley type of storage battery, well known throughout the United States. In the future the manufacture of these storage batteries will be carried on at the extensive works of the Electric Storage Battery company in Philadelphia. Alfred Clarke, formerly general manager of the Eastern Electric Light & Storage Battery company, has been appointed agent of the Electric Storage Battery company, with offices at 333 Exchange building, Boston. Arthur E. Childs is manager of the New England district.

The *Buffalo Courier* of August 21st contained this announcement: An entirely new industry for Buffalo is about to be established. Seven carloads of machinery and supplies for the manufacture of electric bells, annunciators, push buttons, and novelties of many kinds for dwellings, hotels, offices, etc., arrived in the city yesterday. Back of the enterprise is Charles M. Proctor, formerly in business in this city, who has bought the entire plant of the Proctor-Raymond Electric company of Rochester. He is a go-ahead, wideawake business man and he has taken a long lease in the large manufacturing building at Nos. 442 and 446 Niagara street. His plant is worth over $50,000, and he controls a number of valuable patents covering not only devices but quick methods of manufacture. Mr. Proctor says that with his present equipment he will make 1,000 bells a day, and he expects to increase the capacity of his factory in all lines. At first he will employ about 50 hands and this number will be gradually increased. Mr. Proctor has a ready market for more than he can at present supply, his customers being some of the largest electrical houses of Boston, New York and Chicago.

Felix Haac has been indefatigable in introducing machinery wipers of raw silk in the engine rooms of the United States, and his efforts have been crowned with success. He organized the American Silk Manufacturing company in St. Louis eight years ago, relying on his experience in Europe with silk machinery wipers, and has built up a fine business, numbering among his customers many of the largest railway and electrical companies in the country. A few months ago the American Silk Manufacturing company acquired the plant and business of its most prominent competitor, the Royal Silk Manufacturing company of New York, and it now has its own plant in Bucks county, Pa., with the principal office at 311 Walnut street, Philadelphia. To overcome the objection against washing the wipers it was found necessary to devise a special compound for use with the wipers, which is not injurious to the wiper and is economical and efficient in weak solutions, so that the work of cleaning is shortened and rendered easier, while the wiper does not accumulate so much grease and dirt, most of it being left in the solution for cleaning. These silk wipers can be washed and used again and again. They are devoid of the liability to spontaneous combustion —a danger which is always present with cotton wipers.

The Automatic Circuit Breaker company of Newaygo Mich., has placed on the market a full line of automatic circuit breakers for station work, both street railway, light and power plants, stationary and car motors, and for light and power circuits. There is a constant demand for automatic circuit breakers in railway work. Some of the older lines are fed by one main set of feeders with a circuit breaker in circuit at the power house, and as each line or section branches off from the main trunk line an automatic circuit breaker, "enclosed in a neat water and fire-proof box and hung on the pole near the cross arm," is put in circuit at this point. When an accident happens the circuit breaker on the line opens and shuts off just the damaged circuit. The motorman who is nearest the trouble telephones for the repair wagon, and he can give the exact location. After the trouble is remedied the line circuit breaker can be closed, and the section is again alive and ready for work. When an accident happens to the car motors, such as a ground, short-circuit or an excessive overload, a circuit breaker on the car will open and cut out the motor circuit only, leaving the rest of the cars in running order. The Automatic Circuit Breaker company has opened a Chicago office at 937 Monadnock building with L. A. Farnsworth as manager.

## BUSINESS.

The revival in business is felt in a gratifying degree in the supply department of the Chicago Edison company, which reports business as good. Inquiries and orders are coming in briskly, and the volume of trade shows a very marked increase.

The Universal Electric company of Cleveland, Ohio, reports that it has increased the output of its factory to 2,000 incandescent lamps per day, and N. S. Possons and his brother W. J. Possons are kept busy filling orders for the company's high grade lamp, which is meeting with such universal favor.

The Priestman oil engine is sold by Priestman & Co. of Philadelphia. This engine is said to be absolutely safe and of unprecedented economy. Ordinary petroleum oil is used, and it is claimed that one cent per horse power hour represents the outlay for fuel. No engineer or firemen is required, and the engine is very compact.

The White Manufacturing company of 40 and 42 State street, Chicago, is exploiting a powerful "hot blast" gasoline blow-torch for the use of electricians, brass workers and others requiring intense and steadily directed heat. This tool holds three pints of oil, and will burn about four hours with one filling and pumping. It gives excellent satisfaction.

Huebel & Manger of Brooklyn, N. Y., are preparing for a large fall trade by the addition of new machinery and the hiring of extra help to meet the increase in orders. This concern is fast outgrowing its present quarters and will soon have to extend the same to take care of the rapidly increasing business. Huebel & Manger have in preparation a number of electrical novelties which they soon will offer to the trade.

The Western Telephone Construction company shipped to Lynchburg, Va., a large consignment of telephones, to take the place of eastern made telephones which had been in use there, but which did not give satisfaction. The subscribers refused to pay rental, whereupon they ordered some "Western" telephones, which overcame the difficulty at once, and resulted in a complete change. This is a high compliment to the Western Telephone Construction company, as the price paid it is 50 per cent. more than the price of those being displaced.

The Electric Appliance company, Chicago, is showing a good, unsolicited testimonial letter on the Packard transformer from a customer, who states that he has a large assortment of transformers on his lines, among them a number of Packard transformers. During a recent severe storm of lightning eight transformers of almost as many different makes were completely burned out, while the Packard transformers were not injured in any way. The manufacturers claim that, as the Packard transformer is now built, it is practically impossible to burn it out.

The Electric Storage Battery company of Philadelphia has recently closed a contract with the Barr Dry Goods Store of St. Louis, for a battery of 58 chloride accumulator elements, type F-11. This battery has a capacity of about 100 16 candle power lamps and will be used for furnishing the light required by the sweepers and watchmen during the night after the dynamo has been shut down. A contract has also been closed with the Anaconda copper

mines for 270 500 ampere hour cells which will be used for regulating the load on the dynamos operating the trolley line used for hauling material from the mines; the battery will also be used for lighting during two or three months of the year. For the latter work, it will be charged from the railroad circuit and discharged in five series in multiple.

E. P. Roberts & Co. of Cleveland, O., have prepared specifications for the municipal plant at Bellefontaine, O., for 100 arc lights and 1,200 incandescents, the contract for which has been awarded to the Standard Electric company to furnish Standard arc machinery, Westinghouse alternating current incandescent machinery and Dick & Church engines. They are also at work on specifications for a municipal plant for Mt. Sterling, O. Bids are now in, also, under their specifications, for a complete electric and steam plant for a 12-story office building for Cleveland, which will have about 1,500 lights, direct-connected dynamos, and the wiring will be partly molding and partly conduit work. E. P. Roberts & Co. have likewise prepared the specifications for the Lucas county court house, Toledo, O., for 1,500 lights and two 15 horse power motors for ventilating purposes. The wiring is to be in iron armored conduit and the contract has been let to Bissell & Dodge of Toledo, O. In addition to the above, they have recently prepared wiring specifications for a number of buildings and also report business quite active along the line of office advice relative to inventions and work as experts in patent causes.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued September 3, 1895.*

545,469. Electrical Signaling Apparatus. John H. Fildes, Chicago, Ill. Application filed June 12, 1895.

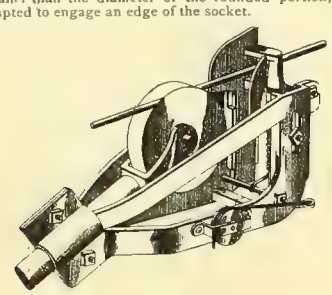
This arrangement comprises the combination with a rail of a railway track and a pivoted lever, arranged to be actuated by a passing train, of a contact carried thereby, forming one terminal of the circuit, a swinging terminal having a bifurcated extension, in which the lever contacts is placed, and an insulated section on the swinging terminal.

545,494. Railway Block Signal System. Alvah W. Hall, New York, N. Y. Application filed June 15, 1895.

A block signal, a normally open circuit closer in conjunction therewith, and adapted to be closed when the signal is at "danger," a supplemental automatic signal, a normally closed circuit track instrument and a circuit, relay and battery.

545,495. Support for Overhead Electric Conductors. Melancthon Hanford, Malden, Mass. Application filed April 25, 1894.

In a supporting device for overhead electric conductors the combination is claimed with a supporting coupling member, having an open socket and a mutilated or flattened bolt secured thereto, and extending from one side to the other thereof, of a supported coupling member having a hook adapted to fit the rounded portion of the bolt the mouth of the hook being smaller than the diameter of the rounded portion, and a lug adapted to engage an edge of the socket.



NO. 545,520.

545,498. Electric Brake. William L. Hedenberg, New York, N. Y. Application filed May 7, 1894.

There is a bar, having a plurality of coils immovable relatively to the bar, and adapted to be drawn toward the wheels, combined with a controller adapted to throw one or more coils in a circuit at a time.

545,520. Trolley Guard. James T. Moody, William Shawd and Adam J. Baker, Springfield, O. Application filed February 23, 1895.

The invention consists of a trolley head, comprising similar side pieces, having a socket at one end to receive the trolley pole, and guideways at the opposite end, means for securing the side pieces together and clamping the trolley pole between them, lateral guards adjustably held in the guideways, a shaft journaled to one of the lateral guards, and having a crank arm to which the releasing rope is attached, a latch guard attached to the shaft, and having its free end entering a notch in the remote lateral guard, and a spring for normally projecting the latch guard across the space between the lateral guards.

545,524. Electric Motor. John O'Neil, New York, N. Y. Application filed June 22, 1894.

The first claim is for the combination with magnets, and a revoluble armature having radial arms, of the heads carried upon the ends of the arms, having bores parallel or substantially so with the axis of motion of the armature, and helices coiled upon the arms, and carried or extended through the bores to promote the magnetization of the heads, and connected with a suitable commutator.

545,532. Telegraph Key. George F. Philbrook, Lisbon Falls, Me. Application filed January 19, 1895.

A telegraph key provided with a pivoted button for automatic circuit closing, the button having leaden weights counter-sunk in it near its outer edge.

545,539. Device for Hoisting or Lowering Lamps. Frank W. Smith, St. Louis, Mo. Application filed December 26, 1893.

A windlass is employed, comprising arms for securing the device to a suitable pole, suitable bearings projecting from the arms, a longitudinally movable revolving shaft within the bearings, a feather on the shaft, a revolving drum and pulley on the shaft, grooves within the drum, and pulley for the reception of the feather, a spring-actuated pawl, a ratchet wheel on the shaft co-operating with the pawl, a crank arm for rotating the shaft, an endless rope winding over the pulley, a fixed pulley and guide pulleys for the same, a rope passing over the drum, a lamp secured to the free end of the rope, a suitable way, a traveling pulley at the end of the rope, and adapted to be secured to the endless rope.

545,553. Electric Igniting Apparatus for Gas Engines. Henry Thau, New York, N. Y. Application filed October 20, 1894.

This combination includes a gas engine and a dynamo suitably supported thereon, having a belt passing over the armature pulley and the flywheel of the engine, with the circuit-closing device arranged to operate without the cylinder; the sparking device is arranged to operate within the cylinder, forming a contact therein before the circuit completed without the cylinder is broken, and to continue the contact within the cylinder after the conducting continuity of the circuit-closing device without the cylinder is broken, until a spark is produced within the cylinder to ignite and explode the gas charge therein and the dynamo circuit broken.

545,554. Alternating Current Generator or Motor. Elihu Thomson, Swampscott, Mass. Application filed September 29, 1891.

The combination consists of an armature, having a series of windings which are alternately reversed, and a field magnet having poles, each subdivided into separate polar projections.

545,569. Electric Tool and Machine. Henry H. Bliss, Washington, D. C. Application filed December 24, 1886.

Important features of this invention are a rotating and longitudinally feeding drill rod, a support therefor, an electric motor, having a rotating armature shaft on the support, gearing between the armature shaft and drill rod, feeding mechanism for the drill rod, and devices for disengaging the feeding mechanism from the drill rod to admit of a quick return of the drill rod independently of the feeding mechanism.

545,570. Electric Coal or Rock Drill. Henry H. Bliss, Washington, D. C. Application filed September 6, 1888.

The cut shows an electric drill or analogous machine, having in combination a field magnet, a rotary armature, an armature shaft, having its bearings on one part of the field magnet, a longitudinally movable driven shaft having its bearings on another part of the field magnet, and a driven wheel concentric with the last shaft, and mounted independently thereof in fixed relations with the field magnet.

545,591. Electric Motor. Otto E. H. Kramer, St. Louis, Mo. Application filed April 23, 1894.

In this arrangement there is the combination of the outer circular series of magnets and the inner circular frame, the pole pieces of the magnets being parts of said frame.

545,592. Electric Motor. Otto E. H. Kramer, St. Louis, Mo. Application filed May 10, 1894.

The combination of two motors, whose armatures run on a single shaft, and are supported solely in outer bearings.

545,599. Water Wheel Governor. Winfield S. Libbey, Lewiston, Me. Application filed August 21, 1894.

Included in the combination are a gate-operating shaft, and a reversing mechanism for the shaft, electro-magnets for controlling the reversing mechanism, a governor, a centrally pivoted lever with which the governor is connected, spring contacts under the ends of the lever, a fixed contact beneath one of the spring contacts and the electrical connections between the contacts and the magnets.

545,620. Cleat for Electric Wires. Montraville M. Wood, Chicago, Ill. Application filed January 11, 1895.

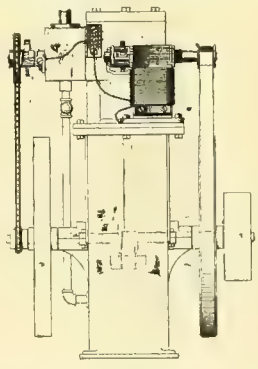
A body having a slot is used, the opening of which is substantially parallel or in line with the length of the wire, and which is curved within the cleat so as to form a hump or bend on the wire to prevent its longitudinal motion.

545,629. Safety Appliance for Electric Conductors. Adelbert E. Hutchins, Detroit, Mich. Application filed May 5, 1893.

Blocks are connected with the sections of the conductor, and there is a frame for receiving and holding the blocks; arms are pivoted within the frame, bearing upon the blocks and operated by springs, and the springs are insulated and interposed between the frame and blocks.

545,649. Trolley Arrester. Henry F. Hildebrandt, Rochchester, N. Y. Application filed May 6, 1895.

The device comprises a case, the top of which is provided with a rigid catch a spring within the case, a cord connected with the spring at one end, and adapted to be secured to the trolley arm at the other, and means upon the cord to engage with the catch of the case.



NO. 545,553.

545,653. Electric Alarm. William S. Hull, Dallas, Tex. Application filed November 26, 1894.

The combination is claimed with the magnet, the armature and the sliding arm thereon, of the contact point, the platina strip and the insulator in a different plane.

545,664. Method of and Apparatus for Controlling Current for Electric Motors. Thorsten von Zweigbergk, Cleveland, O. Application filed November 1, 1894.

The process described of reducing the current for electric motors on street cars and the like by introducing resistance into the circuit consists in connecting the resistance in series in the circuit, forming around the resistance so connected a shunt which includes a plurality of separable contacts in series, and finally simultaneously breaking a plurality of contacts in the shunt.

545,670. Electric Transformer. William F. Brittin, Allegan, Coldwater, Mich. Application filed November 16, 1894.

A feature of the method of preparing the primary and secondary of an electric transformer consists in winding the secondary within layers of the primary, coating the windings with a solution of gum shellac and extract of logwood, and finally drying the coatings.

545,686. Trolley. Zachry T. Furbish, Augusta, Me. Application filed July 12, 1895.

A trolley is described, comprising a forked rod, depending arms secured thereto, and the trolley wheel journaled between the arms, and being adapted to in line laterally in relation to the same.

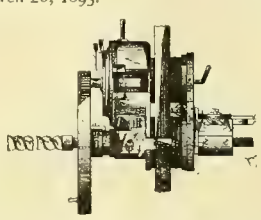
545,693. Asynchronous Motor. Maurice Hutin and Maurice Leblanc, Paris, France. Application filed April 19, 1895.

This method of producing a rotating field of force consists in rotating a flux screen containing circuits closed upon themselves in inductive proximity to a circular row of alternately wound magnets, and passing single-phase alternating currents through the magnet coils.

545,694. Electric Arc Lamp. Rudolf H. Jahr, Opladen, Germany. Application filed November 26, 1894.

In electric arc lamps the combination is claimed with the upper and lower carbons, the regulating helix, and the main regulating resistance of the lamp, of an auxiliary resistance for changing the action of the helix, and a connection between the auxiliary resistance and the main regulating resistance.

545,696. Electric Time Check Receiver. Charles K. Jardine, Georgetown, British Guiana. Application filed March 26, 1895.



NO. 545,570.

The essential features of this invention are the box, provided with a slot the comparted drawer, the chute, the electro-magnet armature lever carrying the armature, and provided with a slot having lugs, the bolt bar, and means for moving the bar and bolt forward when released from the lugs of the armature lever.

545,699. Electrical Annunciating Target. Otto Kauffmann, Sacramento, Cal. Application filed November 15, 1894.

In a registering target there is provided a casing, comprising front and back plates with aligned perforations, a bull's-eye and concentric rings, having on their rear faces rods which project through the perforations, a plate movably mounted behind the rods and adapted to engage and move the same equal distances, and means for moving the plate forward; whereby the rods are engaged thereby, and the bull's-eye and rings brought into alignment.

545,736. Electric Arc Lamp. Rudolph Segerdahl, Chicago, Ill. Application filed April 26, 1894.

Two or more movable electrodes have each an independent regulating mechanism in derived circuit; there are also switching devices for the derived circuits, adapted to cause the regulating mechanisms to operate in a predetermined sequence, and circuits, whereby the electrodes may be caused to burn in succession.

545,755. Carbon Holder for Electric Arc Lamps. Thomas E. Adams, Cleveland, O. Application filed February 15, 1895.

A fixed jaw, having recesses in its sides, a movable jaw, a yoke projecting from the movable jaw and extending through the recesses in the fixed jaw to a point in rear of the fixed jaw, and a thumb-screw passing through the yoke and engaging the fixed jaw.

545,806. Trolley Wire Support. John W. Meaker, Evanston, Ill. Application filed November 17, 1894.

A hanger and a clip movable longitudinally on the hanger and acting to bind a trolley wire directly against the hanger, comprises an important feature of this invention.

545,815. Electric Signaling Apparatus. Benjamin Price, Baltimore, Md. Application filed April 24, 1894.

Claim 1: In an electric signaling apparatus a wheel or sector having a normal progressive forward movement, and provided with a mechanical arrangement of solid keys representing a fixed combination of electrical impulses, in combination with the armature lever of an electro-magnet, arranged to arrest and release the sector, and having a single finger provided with a roughened device to co-operate with the solid key-bars, and thereby arrest its movement by frictional pressure.

545,819. Electric Insulator. Daniel M. Rothenberger, Lancaster, Pa. Application filed March 8, 1895.

An insulator is described, having a transverse opening, vertical or longitudinal side grooves or slots communicating with the opening and forming a transverse web or ligament of a width approximately the same as the diameter of the main wire, whereby the tie wire will have a side and top hold upon the main wire to prevent it from slipping.

545,853. Rotary Field Motor. Alard E. Du Bois-Reymond, Berlin, Germany. Application filed December 26, 1893.

A number of coils are connected at intermediate points with a number of contact terminals the contact terminals being arranged in a circle; a number of brushes, one for each coil, are mounted to be moved over the terminals, and adapted to make contact with corresponding terminals of the several coils, whereby the effective lengths of the several coils may be varied at will.

Western Electrician.

EVERY SATURDAY.

Vol. XVII. CHICAGO, SEPTEMBER 21, 1895. No. 12

## Telephones and Telegraphs at the Chicago Board of Trade.

It is of the utmost importance to the brokers doing business on the floor of the Chicago Board of Trade that the quickest possible means of communication be provided with outside commercial centers, and also with customers and principals at outlying offices in Chicago, so that immediate advantage may be taken of the constant fluctuations of the market. In fact, it would be practically impossible to conduct the business done on the Board, as it has grown and developed, were it not for the fact that the outside world is in constant touch with the exchange by means of the multitude of electrical wires that radiate from it in every direction.

The telegraphic business transacted on the floor of the Board is enormous in extent, and now this service is to be supplemented by a large number of private-line telephones. For years the directors of the Board of Trade fought the introduction of telephones, for the reasons, principally, that it was feared that the quotations would get into the bucket shops by this means, and that the introduction of telephones on the floor would depreciate the renting value of offices in the building for brokers' use. The management was at last convinced, however, that these objections carried little weight in comparison with the great advantage of word-of-mouth communication between the members on the floor and their partners or representatives in outlying offices. The danger of the lines furnishing information to bucket shops is thought to have been overrated, while, instead of interfering with the desirability of having offices in the building, it is found that many of the tenants of the Board are among those most anxious to have telephones. So, by recent action, the rule was changed, and the Chicago Telephone company has just completed the installation of 12 instruments on the floor of the exchange. In addition 24 additional telephones will be put in immediately, and others will follow as the demand warrants. The brokers are beginning to realize the great advantage in economy of time attainable by the use of telephones, and, as the idea spreads, it is not unlikely that 100 or more instruments will be in use.

The 12 instruments now in place are in the northeastern portion of the hall, beneath the private visitors' gallery and but a few feet from the wheat pit. They are placed closely together, with "wings" extending outward from the upper portion, as shown by the view of several of the instruments presented on this page. The telephones are all on private lines, of course, and are not connected in any way with the telephone exchange, merely serving for direct communication between members on the floor of the Board and their offices. The instruments are provided with metallic circuits and are of the long-distance common battery type.

The chief novelty of this installation is the method of signaling employed. It would be entirely out of the question to attempt to make use of the ordinary call-bells in the uproar of the Board of Trade, so General Manager Hibbard of the Chicago Telephone company devised a system of visual signals which seems to meet all requirements. This consists in placing a 16 candle power incandescent lamp over each telephone, in a metal box into which the number of the telephone is cut, and a corresponding lamp and number in a row high up on the gallery. The idea is an outgrowth of the experience with lamps in the main-express system at the telephone exchange, but this adaptation is believed to be entirely new.

In operation, if the broker at his office removes his telephone from the hook, the electric lamps representing his telephone on the Board of Trade are lighted. One of these lamps being placed immediately over the telephone instrument and the other in a conspicuous place along the wall, the representative on the floor of the exchange can readily tell when a call is made for him on the telephone. When, replying, the representative on the Board removes the telephone from the hook, the lamps are extinguished and remain extinguished until another call is made. In the illus-

FIG. 1. TELEPHONES AND TELEGRAPHS AT THE CHICAGO BOARD OF TRADE.—PRIVATE-LINE INSTRUMENTS ON THE FLOOR OF THE EXCHANGE.

tration, Fig. 1, there are calls from telephones 9, 10, 11 and 12, while 7 and 8 are in use, the lamps not being lighted. The higher row of lamps and numbers, to attract attention at a distance, is not shown in the picture.

Provision is made for making a call from the Board of Trade to the broker's office by the use of a push-button. On account of the fact that the instruments on the Board of Trade are placed side by side, the upper portion of each is enclosed in metal partitions, so that the user is free from the observation of any one using the adjoining telephone. In order that the user of the telephones on the Board may have the opportunity, as much as possible, of facing the wheat pit, or any other desired portion of the room, the transmitter arm is provided with a universal joint by means of which it not only may be lowered or raised, but may be turned from right to left so that it may be used in any position. Although the room is very noisy during office hours, it has been found possible by properly placing the transmitter and by the proper arrangement of the transmitter cut-out button to shut out the noise of the Board itself while the message is being received.

The method of operating the incandescent lamps is that which has been used by the Chicago Telephone company in operating trunk line signals and in operating its main-express system. A relay is connected to the line when the telephone is on the hook. This is furnished with current from the main battery when the circuit is completed by the removal of the telephone from the hook at the distant station. The armature of the relay being attracted in this manner, its local function is to close the 110 volt circuit operating the 16 candle power lamps which serve to furnish the signals. The lamps are inclosed in metal boxes about eight inches high and five inches wide. In the box the figures are cut out on the front and sides, and back of each is a piece of ground glass which serves to diffuse the light evenly.

The position of the telephones is such that brokers can stand at them and make trades with men in the pit by signals with the uplifted hand. This will undoubtedly be done to a large extent. It is objected by some that there is no record of an order received over the telephone, but as there is no record of the majority of trades on the Board at present, it is not thought that this criticism will have much weight.

An amusing instance of the overmastering desire to speculate ever present in the Board of Trade broker's breast was developed during the testing of the lamps over the telephones. First one lamp, say No. 3, would burn, then No. 11, and so on at random. This attracted the attention of the men in the pit, and soon all sorts of bets and pools were made on the next number to show up. It was as exciting as faro, and for a time it was rumored that the officers of the Chicago Telephone company were to be apprehended for running a gambling game at the Board of Trade. The novelty of the thing soon wore off, however, and the brokers went back to their more serious vocation.

The telegraphic business on the Board, as has been said, is of enormous extent; in fact, the Chicago Board of Trade has the largest branch telegraph office in the world. The Western Union and Postal companies have 170 operators on the floor every working day, packed in a space of between 2,000 and 2,500 square feet in the northwestern corner of the hall. The business is about equally divided between the two companies, and the Western Union alone has handled 12,000 messages in the few working hours of the Board of Trade day. Every commercial center in the country has direct telegraphic connection with the Chicago Board of Trade, and there are about 20 circuits to New York as well as direct cable connection to Europe. Every effort is made to handle messages quickly, and on an average the message is in the hands of the addressee in from 30 to 45 seconds from the time the last word is taken down by the operator. No copies are taken, and the messages are not receipted for; nevertheless the accounts of the companies are rarely disputed. Everything is done in the simplest, most direct manner, with the one idea of saving each fractional second of time possible. The messengers are all familiar with the faces of the men on the Board, and there is no formality whatever in getting the dispatch into the hands of the man for whom it is intended. During the busy hours the scene about the telegraph counters and, indeed, all over the floor, is one of much bustle and excitement. A good representation of the imposing exchange hall of the Board, as it looks on a holiday, is given in Fig. 2. A glimpse of the telegraphers' quarters may be seen in the lower right-hand corner.

## William II. as an Electrician.

The Hohenzollern, the yacht of the emperor of Germany, says *L'Electricien*, has been furnished, from suggestions by its illustrious passenger, with an emblematic representation in miniature colored lamps, at the summit of the main-mast, of the iron cross with the eagle, on a gold ground strewn with small eagles and crowns.

His majesty, who is fond of tinsel and glitter, says the French journal, is ravished with this new form of electrical light house, which in the night produces a veritable fantastic effect.

## High Potential Dynamo for Laboratory Practice.

Laboratory practice, says *L'Industrie Electrique*, often necessitates the use of a generator of high tension but of small current. This is often accomplished by coupling up primary batteries or accumulators in series, sufficient in number to obtain the desired pressure. Such procedure is open to serious objections: It is unwieldly, costly, disagreeable and onerous to maintain, often difficult to insulate, variable as to results and therefore generally unsatisfactory. Not so the dynamo. It far more perfectly satisfies the conditions, requiring but little space, being moderate in cost, easy of maintenance, reliable as to voltage agreed upon from maximum to minimum, and variable at will according to speed and excitation. These are some of the advantages of dynamic over voltaic current, to which the laboratory of the Sorbonne can testify. Mr. Hurmuzescu, an attache of the laboratory, conceived the happy thought of procuring from the old house of Cail a dynamo of 0.2 ampere at 3,000 volts, which he desired to use in the study of the variations of resistance of metallic salts under the influence of high-tension currents, and in other investigations.

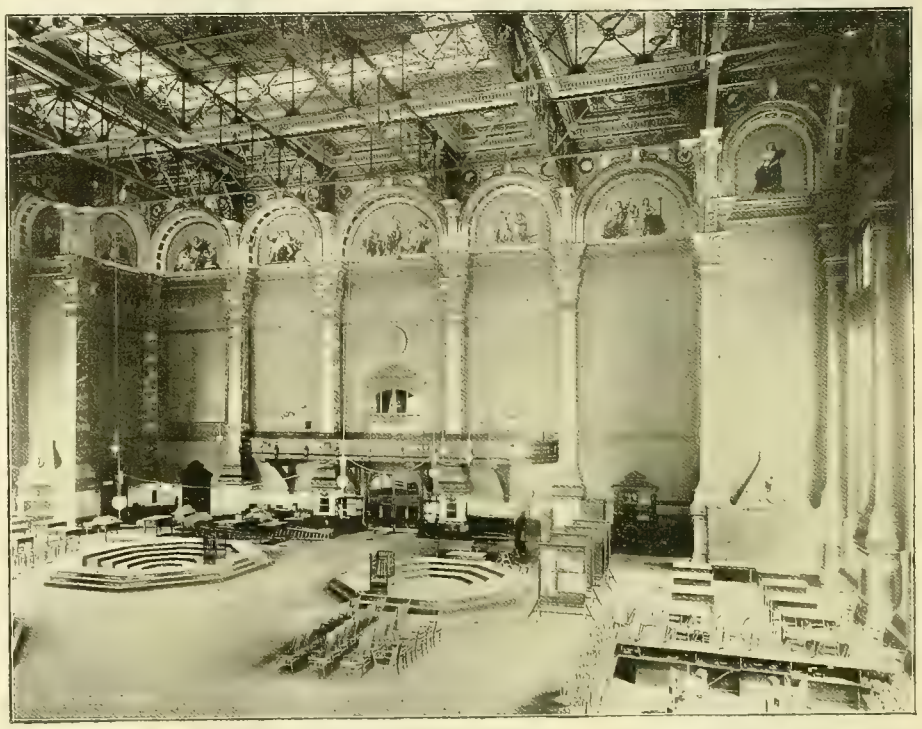


FIG. 2. TELEPHONES AND TELEGRAPHS AT THE CHICAGO BOARD OF TRADE.—GENERAL INTERIOR VIEW, SHOWING A CORNER OF TELEGRAPH OFFICE.

The Cail machine is shown in Fig. 1, while Fig. 2 shows a longitudinal section of one-half the machine, and Fig. 3 a transverse section through *C D* and *G H*. The shaft carries four rings, each capable of furnishing 0.2 of an ampere at a potential of 750 volts, so that it is easy to obtain, by different combinations, 750 volts at 0.8 ampere, 1,500 volts at 0.4 ampere, 3,000 volts at 0.2 ampere, an elasticity of extreme value in experimental work, and further, this division is of great possible value in case of accident, for the destruction of one of the divisions will still leave three available to continue investigations.

Each of these divisions is made up of extra soft sheet-iron plates, three-tenths millimeter thick, with an outside diameter of 25 centimeters and interior diameter of 19.4 centimeters. They are dressed and fixed upon a bronze cross-bar with eight branches, without lateral jaws. Each plate is separated from the next by thin paper and is afterward varnished with shellac. It is then pressed and dried, when the mass has a thickness of 4.8 centimeters. The core has three insulations: first cotton tape, then silk tape, then cotton again. Each bobbin of a ring comprises 160 sections of 66 turns each (or 10,560 wires at the periphery) of a wire 0.3 millimeter diameter, in nine layers. The wires are insulated from the binding hoops by layers of mica. Each ring when complete was plunged into a bath of paraffine at a temperature of 150° C., while at the same time an intense test current was sent through the coils.

The collector, of copper, comprises 160 plates having an exterior diameter of 20 centimeters.

Fig. 2 shows clearly the mode of mounting the cross-bars. The shaft is supported by three standards which do not touch the conductors.

There are but two exciter cores, each of these corresponding to two field rings. The exciter current is of 110 volts. Each of the four exciter bobbins is made up of 16 layers of 1.4 millimeter wire, with 58 turns in a layer, or 1,856 turns in the spool. The air space between the polar masses is 1.8 centimeters.

When the four rings are connected in series, giving 0.2 ampere at 3,000 volts with a speed of 1,500 revolutions per minute, there are about 3,000 ampere turns in each exciter coil.

The resistance of a ring being 128 ohms, the loss by joule effect for each, under these conditions, is 5.12 watts; the mean corresponding induction in the iron of the ring is 12,150 gausses; the loss by hysteresis according to Steinmetz's formula (calling $\eta$=0.003 for the extremely soft sheet-iron) is 28.66 watts; assuming a similar loss for Foucault currents in this iron and in the induced wire, there is a total loss of 62 watts per ring. The corresponding cooling surface is 1,500 square centimeters, which gives 24.2 square centimeters per watt of total loss. This, considering the perfect ventilation obtained, explains why the elevation of temperature in the rings is practically nothing.

With a constant external resistance the potential remained absolutely constant. The following table of some experiments made with the dynamo, as tests, is interesting:

| Speed. Revolutions per minute. | Intensity of the exciter Amperes | Tension. Difference of Potential. Volts. |
|---|---|---|
| 1,000 | 0.9 | 1,652 |
| 960 | 1.5 | 2,518 |
| 1,061 | 2.0 | 3,954 |
| 1,028 | 2.5 | 3,503 |
| 1,040 | 2.7 | 3,554 |
| 1,087 | 3.0 | 3,929 |

These tests were all made with the four rings in tension. The final test is particularly interesting, the tension obtained being nearly 4,000 volts.

## National Electric Light Association.

A meeting of the executive committee of the National Electric Light association was held at the Murray Hill Hotel, New York, Tuesday evening, September 10th, with the following members present: C. H. Wilmerding, president; E. F. Peck, vice-president; C. O. Baker, Jr., master of transportation; Charles R. Huntley, E. H. Davis, A. Markle, W. R. Gardener, G. A. Redman, J. J. Burleigh and John A. Seely. A committee composed of John A. Seely, E. F. Peck and A. J. DeCamp was appointed to consider the matter of holding an electrical exhibition in connection with the nineteenth convention of the association, to be held in May, 1896, in New York. This committee was clothed with power to act, and will report as soon as possible to the full board. In the meantime the friends of the project should take steps to secure an expression of opinion from prospective exhibitors that would warrant the undertaking.

## Accumulator Traction.

By Maurice Barnett.

Now that storage battery cars are to be introduced in New York on the Fourth avenue railway, on the understanding that if they prove more practicable and economical than other representative traction systems the cars on the Fourth and Second avenue lines will be equipped with storage batteries, it is a matter of considerable interest to railway and electrical men to know how far the hopes of friends of the storage battery are liable to be realized, and what showing battery traction will make against its competitors, (1) the trolley system and (2) the underground conduit system. In this connection it might be said that although the underground conduit system has obtained a foothold here sooner than the storage battery system, it is very doubtful whether the former will ever come into general adoption. The closest estimates on total investment, including real estate, road and complete equipment—estimates based on a study of the systems in New York and Washington—put the cost of the underground system at about $100,000 per mile of track length, or between three and four times that of the storage battery system. Moreover, the total operating expenses of the underground system, including interest on investment, is about 19 cents per car mile, against 15 cents for the trolley. This large difference is accounted for by the excessive interest charge which the former system must pay. The necessity for some system other than animal traction and trolley traction has, of course, led to the adoption of the underground conduit, but it is almost certain that just as soon as it shall have been demonstrated that storage battery cars can compete, under certain conditions, successfully with the trolley system, underground conduit systems will play an insignificant part in the development of electric traction systems in the United States.

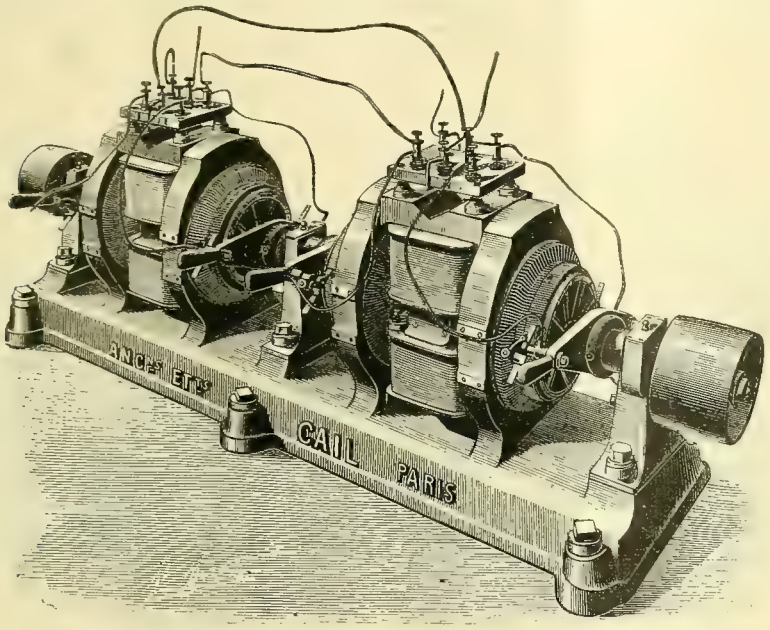


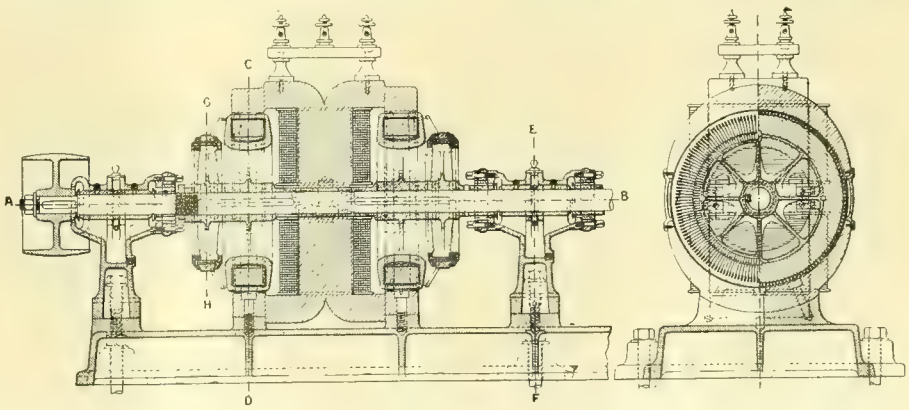

FIG. 1. HIGH POTENTIAL DYNAMO FOR LABORATORY PRACTICE.

The Electric Storage Battery company of Philadelphia, which is putting in the new cars in New York, appears to be sanguine as to the results which will be obtained with the new cars, which, in many respects, embody radical points of departure from previous types of storage battery cars. The Storage Battery company is basing its estimates as to the capability of the cells upon actual knowledge of the work that is daily being done with the "chloride accumulator" in storage battery traction in France, where a type of battery similar to that to be employed in New York has given more than satisfactory results.

There has never been any doubt as to the advantages possessed by a storage battery system of electric traction, the only doubt ever expressed being one concerned solely with the question of operating expenses. The great drawback has been, not as many persons think, the weight of the battery, but the cost involved in the maintenance and handling of the cells in traction work. In the old style of storage battery cars the battery was placed in the sides of the cars under the seats. The expense of inserting and removing it each trip added considerably to the operating expenses. In the new cars the battery will be placed under the car where it can be handled easily and at about one-quarter the former cost of this operation. A report by J. Sarcia, which can be found in the *Bulletin de la Societe International des Electriciens* leads to the hope that the cost of maintaining and handling batteries in traction service will be, in the style of car suggested, something under 3 cents per car mile. We hope subsequently to be able to show that this amount can be made up by a saving in interest, a diminished expense for maintaining the motor equipment and a smaller cost for the motive power.

The favorable features of a storage battery system of traction are well known, and have reference to the fact that each car is a unit by itself, independent of the power house, during its trips, and in no way embarrassed by derangement in the station or overhead equipment—differing in this respect from the trolley system, where a stoppage in the power house or trouble on any section of the circuit may hang up all the cars on the line or in the section, as the case may be, until the trouble is remedied. Again, as the load on the engines and dynamos in a storage battery system is constant, it follows that these need not have greater capacity than is sufficient to satisfy the average demand for power. In the trolley system the capacity of the power plant must be such as to enable it to respond to the maximum demand made upon it. As this demand is very variable, being anywhere from 20 to 300 per cent. above the average demand, it follows that the power plant for a storage battery system will be considerably smaller than that required for the trolley system. O. T. Crosby puts the relative capacity required by the trolley and battery system power plant, respectively, as 1 : ⅔; in other words, the battery system will require a power plant only two-thirds as large as that required by the direct system. In considering, later on, the relative cost of construction under the two systems, this ratio will be taken. This, incidentally, emphasizes the value of an auxiliary storage battery plant for roads already equipped with the trolley system, the storage battery serving as a reservoir to store up the energy representing the difference between the average and the maximum demand on a generating plant, and as a regulator, enabling the engines and dynamos to be worked at a constant load and securing them from the strains and stresses to which they would otherwise be subject.

Furthermore, in the storage battery system there is no loss of pressure in "feeders" and "line;" the grounding of one motor does not affect others; the durability of the motors is greatly increased by reason of the low pressure used in this system; and lastly, there is not the unsightly trolley line with the attendant danger to life and property growing out of the high-tension current and obstructive wires employed in the direct system. In the event of a positive proof that the storage battery car is capable of efficient service at the same or even slightly greater expense than the trolley cars, attention will again be directed to the advantages of the storage battery system—when a tendency may be manifest to limit the construction of overhead lines and multiply that of the storage battery system—the first system of electric traction tried here or abroad, and neglected only because the difficulties in the way of its adoption were not worked out so quickly as in the case of its competitor, the trolley system.




FIGS. 2 AND 3. HIGH POTENTIAL DYNAMO FOR LABORATORY PRACTICE.—LONGITUDINAL AND TRANSVERSE SECTIONS.

In order to arrive at an approximate cost of traction by storage battery cars we may consider separately the various factors entering into this. What chiefly interests us is the factor of maintenance and handling. This, according to the report of M. Sarcia, already referred to, was 3⅓ cents per car mile—a figure, however, susceptible of marked reduction. In order to explain this and at the same time to show that the basis of the foregoing figure was a set of conditions not wholly favorable to storage battery traction, it may be interesting to give, in brief, a synopsis of M. Sarcia's report descriptive of the industrial application of accumulators to electric traction made by the Tramway of Paris and the Department of the Seine on the lines of St. Denis to Paris and of St. Denis to Neuilly.[1]

The lines in question, which are known as (1) St. Denis-Madeleine. (2) St. Denis-Opera, (3) St. Denis-Neuilly, have their termini near the depot of St. Denis. On these lines electric traction superseded horse traction June 1, 1892, and up to the present time about 2,000,000 car miles have been covered by the storage battery cars. On these lines the grades are fairly severe, being as high as 4 per cent. for considerable distances and ranging frequently from 2 to 2½ per cent. On the Madeleine line each car covers daily from 88.8 to 97.5 miles. With horse cars the distance covered daily was not over 60 miles. The conditions on the Opera line differ in so much as the motor car tows an ordinary car holding 50 persons,—making 100 persons carried in all on this line by each motor car. On the Neuilly line each car makes two trips out and back on the Opera and Madeleine lines—or about 30 miles on a single charge of the battery. On good Vignole rails, where the traction coefficient was only 13.2 pounds to the ton, the distance covered on each charge of battery was no less than 70 miles. Continuing, M. Sarcia points out that in order to replace a discharged by a fresh battery, it was necessary to handle 24 trucks, the men having frequently to roll these the entire length of the charging rooms, involving a very large expenditure of labor. The necessity for this grew out of the circumstance that the company, instead of building a modern power house with every convenience for the handling of the batteries, rehabilitated the old horse-car stable and converted it into a charging room. Obviously, economy in handling could not be expected under such conditions. Moreover, instead of supporting the battery under the car, it was placed in the sides of cars underneath the seats. Sarcia estimates that in the style of car to be used in New York a saving of .6 cent per car mile could be effected in handling. Subtracting this from 3⅓ cents given as a result actually obtained in practice, we have 2.7 cents as cost per car mile for maintenance and handling of battery.

The cost of power will depend on price of coal at power house, cost of labor, oil, waste, water and other supplies—illustrating the difficulties encountered in making a comparative estimate of costs of power in different systems. From a paper by T. S. Badger on the cost of construction and operation of electric railways, we find that the average cost of power per car mile of 22 trolley roads with from three to 140 cars in operation, length of track three to 51 miles, daily mileage 80 to 150, average daily mileage 110,

1. This road and the arrangements for handling batteries were described and illustrated in the WESTERN ELECTRICIAN, June 22, 1895.

was 1.96 cents. Now as in the storage battery system engines [illegible] are run at a constant load, it is safe to assume [illegible] of power, neglecting interest and depreciation, [illegible] 80 per cent. of the figure given, or 1.5[illegible] per car mile. Authorities are not wanting who ascribe to the storage battery system an even greater efficiency. In Dubuque, Iowa, with a comparatively small number of storage battery cars in operation, the cost for power was only 1.80 cents per car mile—bearing out the belief that 1.5 cents is quite within the limit for well designed power houses operating a fair number of storage battery cars.

As already noted, owing to the low pressure used in the storage battery system, the durability of the motors is very greatly increased. The average maintenance cost of the rolling stock of the 22 trolley roads cited is 1.80 cents per car mile. M. Sarcia puts this factor at 1 cent per car mile. In New York, where every effort will be made to introduce the very best electrical equipment and carry on the work under the most favorable conditions, it is safe to say that the true figure for maintenance of rolling stock will not be more than .8 cent per car mile.

Regarding maintenance of power plant, it may be said that inasmuch as the power plant in a storage battery system need be only two-thirds as large as that in a trolley system, the maintenance cost will be only two-thirds as large. As a matter of fact it will probably be only one-third as much, since the machinery is free from the strains to which it is subject in the direct supply system. There being, furthermore, no external circuits, lightning is less apt to play havoc with the electrical part of the equipment.

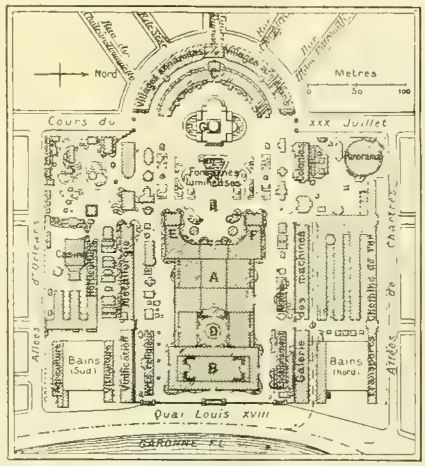
Coming now to the question of interest on total investment, consider first the investment per mile of track laid of the trolley system. Trolley construction, where iron poles are used and where, as in cities, the feed wires must be buried, will cost about $12,000 per mile of single track. As 16 to 20 foot cars can be had fully equipped for, say, $3,250 each, two cars (to the mile) will cost $6,500. Making an allowance of 15 horse power per car at $100 per horse power for power plant, but not including real estate or buildings, we have for the two cars $3,000. The cost of roadbed will add about $7,500 per mile of track, while real estate, buildings, etc., may be assumed to be $7,000 per mile of track—making a total investment of $36,000 per track mile. On the basis of 56,000 car miles run per annum per mile of track length, we have at 6 per cent. per annum an interest charge of 3.85 cents per car mile run to be added to operating expenses. For storage battery construction there is an item approximating $7,600 for batteries for the two cars not found in trolley construction. On the other hand, a saving is effected of $12,000 for overhead construction, while the cost for power equipment and real estate is reduced by one-third, being $2,000 for the former and $4,666 for the real estate, buildings, etc. We thus have a total cost of construction of $28,267, or, say, $28,000; and with the same trackage as in the case already considered, we have an interest charge, per car mile, of 2.99 cents.

Assuming that in the two cases just considered maintenance of roadbed and track, transportation and general expenses will remain the same, we can arrange in parallel the values already given. A general distribution of expenses per car mile is then as follows:

| | Trolley | Storage Battery |
|---|---|---|
| | Cents. | Cents. |
| Maintenance of roadbed and track | .54 | .54 |
| Maintenance of line | .18 | .. |
| Maintenance of power plant | .36 | .12 |
| Maintenance of rolling stock | 1.80 | .60 |
| Maintenance and handling of batteries | .... | 2.70 |
| Cost of power | 1.96 | 1.56 |
| Transportation expenses | 4.93 | 4.68 |
| General expenses | 1.26 | 1.26 |
| Interest on total investment | 3.85 | 2.99 |
| Total | 14.93 | 14.95 |

As given here the cost of operating cars by the trolley and storage battery systems respectively, on roads of 15 miles and upward, with 20 or more cars averaging about 100 miles daily, with moderate grades—general conditions covering cost of fuel and supplies, wages, etc., being uniform—shows both systems to be on an equal footing. A set of conditions slightly in favor of storage battery construction would show greater economy for the battery system. Thus, if the length of track was large in proportion to number of cars run, the extra interest on greater relative cost of trolley construction would swell the operating expenses of the trolley system. Or, again, since the item of fuel is the largest factor in "cost of power," localities where fuel is high priced would change the totals and make battery traction more economical.

In conclusion, it may be said that even if trolley traction were more economical than storage battery traction, the system would be open to the objections that the (1) cars are dependent at all times on the power house, and have no automobile character as have battery cars; (2) the moment the trolley leaves the line the cars are left in darkness; (3) the high tension currents constitute a source of danger to the traveling public; (4) the trolley line is unsightly; and (5) overhead wires are a formidable obstruction to firemen engaged in the never pleasant work of fighting fires. Inasmuch as a successful storage battery system would be, both from the point of view of the public and the street car company, what F. L. Pope calls "an ideal solution of the problem of electrical transportation," it is evident that this system, having total first cost and operating expenses in its favor, is bound to have a speedy and wide development and play no insignificant part in the future history of electric traction in this and other countries.




A, Central Gallery; B, Girondist Palace, C, Palace of Electricity; E and F, Girondist Galleries; G, Monument of the Girondists; the river Garrone is shown at the bottom of the cut.

FIG. 3. BORDEAUX—ITS THIRTEENTH EXPOSITION.

## Bordeaux—Its Thirteenth Exposition.

The Bordeaux "National and Universal" exposition of 1895, like its predecessors, is being held under the auspices of the Philomathic society, founded in 1808, with 69 charter members—gentlemen of culture, public spirited and philanthropic, who proclaimed as the object of the association: "All that can contribute to the progress of useful and agreeable knowledge is the object of the Philomathic society; its end is to incite emulation, encourage industry and aid talent."

The membership roll has grown from 69 to 900, and the names of the elite of the Bordelaise shine proudly in the roster, so that it is admitted that the individual is honored, not the society, by the union.

Bordeaux held its first exhibition in 1827, and it was continued 40 days. From that date to the present, the expositions, like the association, have grown in importance, until the Bordeaux exposition is a center of attraction, not only in France, but upon the continent for tourists and sight-seers. The site of the exposition for the last four occasions has been the "Place des Quinconces," so named from the arrangement of trees ornamenting it, and the twelfth exposition made a record of 6,000 exhibitors and 1,000,000 visitors.

The Place des Quinconces (quincunx) has about 100,000 square meters of surface, and while this space is looked upon as restricted, the society disliked much to change its habit, at, because here was where success first fully crowned its efforts, and so this was selected for at least one more attempt, previous to a change for more elaborate accommodations.

Fig. 1 represents the entrance to the exhibition, Fig. 2 the Palace of Electricity, and Fig. 3 the ground plan on a very small scale. The illustrations are reproduced from *La Nature*.

The exposition is composed of one principal building, comprising one vast nave, an immense rectangular hall called the Gironde Palace, of which the extremely decorative facade is raised above the parallel quay of the river Garonne (Fig. 1). The other facade terminates in two pavilions facing the monument of the Girondists. Back of the Palace of Wines is the Cupola Hall *D*, Fig. 3, a very high building which includes a theater, and surrounds the gallery of the first exposition of social sciences. This hall will also be used by congresses and musical assemblies and exhibitions. The Dome or Cupola Hall is surrounded by a gallery, access to which is gained by an elevator and from which there is a fine view of the grounds and the bay.

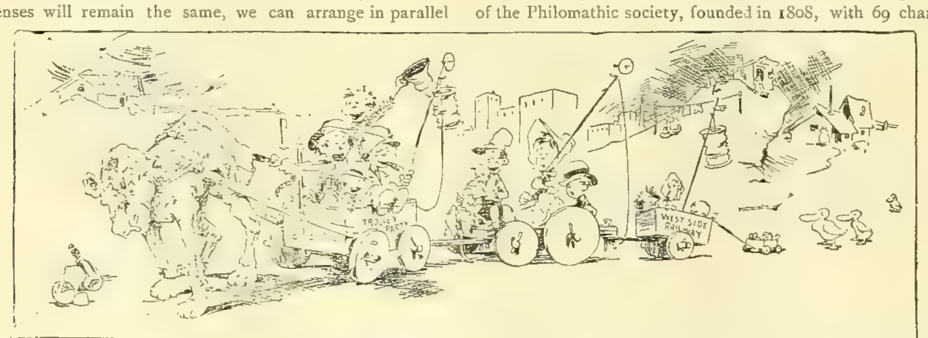
The electrical portion of the exposition centered in the hemicycle *C* shown in Fig. 3, while in another portion of the grounds there will be exhibited a novelty in the form of an electrical house, where every function possible will be actuated by electricity. Every conceivable application of electric current to the needs of housekeepers will be given practical application here. Doors will open, bells will ring, and telephones talk; cooking, warming, ventilating, lighting, ironing, the running of a sewing machine and the operation of electric carpet sweepers, all will be done by electricity; and if there is any application omitted, the promotor of the scheme will be thankful if the reader will suggest it, that it may be included in the grand plan. There will be luminous fountains, of course; that goes without saying, and no end of lights, little and large, all through the grounds; and one can see no reason why the thirteenth Bordeaux exposition should not be more than ever a success, for while the description here given is meager and imperfect, it is known to be a fact that the overflow covers as much ground as that described, and the annexes are by no means few and far between. The readers of this journal, however, are chiefly interested in that portion devoted to electricity, and it is only necessary to say that this department will be in keeping with the importance of the industry.

## Electricity in California Gold Mining.

An interesting article has been prepared by A. E. Hamilton upon the resources of El Dorado county, California, in which he says that the mining industries are only beginning to show their great value, and the assiduity with which capitalists are seeking opportunities in these properties is proof convincing of the interest men are taking in California gold mines.

Of motive power for mining and other purposes he says:

Commensurate with the importance of mining industries and intimately related to them for this portion of the country is motive power. Capital can find opportunity here for fruitful investment. Power can be generated on the South Fork of the American river in a central location equal to that at Folsom. Mills could be supplied within a radius of 30 miles, and electric power thus at the disposal of millmen would stimulate mining in this county to such an extent as would yield great dividends to both the enterprises. It is true the Pearson brothers of Placerville have begun a plant on the American river, built 1,500 feet of ditch, done some tunnelling and finished the flume grade. Though they are persevering in their undertaking they lack capital for rapid prosecution of the work. The situation is exceedingly favorable for the introduction of electric power. Not only would mining industries be served, but the hundred and one other purposes to be supplied within the district would yield a good revenue. It is to be hoped that capitalists seeking opportunities will not overlook this chance. It is but 2½ miles from Placerville to the river, where the plant is now in course of construction, but proceeding slowly for the lack of funds. The outside world has scarcely an adequate idea of the opportunities offered by El Dorado county in her mines and electric facilities.



NEW YORK TROLLEY PARTY.

## New York Trolley Party.

The accompanying sketch, reproduced from the *New York Herald* of September 8th, gives a fair idea of the condition of the eastern metropolis so far as its facilities go toward providing the people up-to-date advantages and pleasures such as other communities enjoy. The *Herald* entitles its sketch "The Latest in Trolley Parties," and it prints in connection with it this warning from "Casey," the social leader in charge of this fashionable expedition: "Hol' on tight, Chimmie, an' don't drop der trolley pole." Poor old New York.

## Bell Company to be Attacked.

It has been decided to attack the American Bell Telephone company under the anti-trust laws, and information has been lodged with United States District Attorney Black of Chicago and Attorney-general Maloney at Springfield, charging the Bell company with violation of the federal and state laws. These actions have been instituted by the American Telephone Protective association, which has been collecting and compiling evidence in this case for some time. President Keelyn has made the following statement of the case:

The American Bell Telephone company of Massachusetts is a parental organization. In the state of Illinois it licenses the Western Electric company to manufacture apparatus for this section, the Central Union Telephone company to operate exchanges in Illinois, Indiana, Iowa and Ohio, and the Chicago Telephone company to operate exchanges in Chicago and suburban cities. These three are all Illinois corporations. The Bell company also licenses the American Telephone & Telegraph company to operate the long-distance telephone, and gives it the exclusive toll service between cities. This is a New York corporation.

In addition there are from two to five subcorporations in every state and territory besides Illinois, holding licenses from the Bell company. The Western Union Telegraph company is interested in all these licenses with the Bell company to the extent of 20 per cent. This is the result of the litigation many years ago on the patent question, when the Bell company, the Western Union company and other telephone interests settled their differences and entered into a gigantic combination. A monopoly was created by specific contract. This was before the enactment of the anti-trust laws. The contract provided that discrimination should be made in favor of the allies of both companies and that all competitors should be barred.

It prescribes who shall use telephones, how they shall be used, and the minimum prices to be charged for their use. The contract expressly prohibits the use of telephones by competitors of either of the contracting parties. It provides that contracts shall be made with favored allies, and none other for telephone service throughout the country, expressly circumscribing the rates to be charged.

This neutral agreement made the Bell company a paternal organization, and provided for it a majority of the stock in all the other corporations except the Western Union company, which was given one-fifth of all royalties. The basis of the contract was to prohibit competition with the Western Union company in telegraph business and to prohibit competition with the Bell company in telephone business. The contract definitely requires both concerns to absorb all interests then existing outside of their own in telephone lines and forcing them into the combination either through purchase, contract or litigation. The laws of both Illinois and New York have been violated in carrying out this contract. There has been a restraint to trade both in the manufacture and use of telephones and the creation of an illegal trust.

The combination has been kept up by the power of the Bell company, which absolutely controls all the sub-corporations. The day of reckoning is near, however, as the independent companies are driving it from the field. The independent companies are able to charge one-half the Bell company's rates and yet make a net profit of 30 per cent. They are able to do this by modern apparatus and economy of operation, and also by the absence of watered stock.

---

The large plant of the Detroit railway at Atwater and Riopelle streets is to be completed by October 1st. The building is 230 by 135 feet and will contain Allis engines and Walker generators of a capacity of nearly 4,000 horse power.

## Telephone News from the Northwest.

[From the Minneapolis corre... of the WESTERN ELECTRICIAN.]

The authorities at Davenport, Iowa, are taking steps to remove about 20 per cent. of the telephone, telegraph and electric car poles.

The council of Sheboygan, Wis., has granted a franchise to the Northwestern Telephone & Construction company of Milwaukee. The ordinance granting a franchise to the National Telephone & Construction company was not even considered. The Northwestern Telephone company is arranging to put in an exchange at Anoka, Minn. They have secured 25 subscribers. Automatic switches will be used.

The Phœnix Telephone company of Indianapolis, which is arranging to begin construction at Mankato, Minn., contemplates covering North and Northwestern Iowa and Southern Minnesota up the Blue Earth valley with telephone lines. They have put up 200 miles of wire this season in Northern Iowa, and will in time lead into Mankato. When they have an exchange in there they will build into Minneapolis.

The Western Electric Telephone company is combatting the Iowa Union at Mason City. They expect to reach Sioux City on the west and Minneapolis on the north soon.

The Winona Telephone company of Winona, Minn., contemplates building to Witoka, Dakota, Dresbach and Pickwick, Minn. Rochester, Minn., has extended an invitation to continue to that point, and as the company has a line to Dover, it will be but a slight extension from there on.

Telephone communication is established from Bancroft, Iowa, to Sweat City and Armstrong, Iowa, and the line is being rapidly extended.

The Northwestern Telephone Exchange is putting in higher poles at Stillwater, Minn., to overcome the noises from trolley cars, owing to the wires having been nearly parallel heretofore.

Oregon, Wis., parties contemplate building a telephone line to Madison, Wis.

An effort is being made at Fargo, N. D., to extend the telephone line from that place to Lisbon, N. D.

The People's Electric company of Madison, Wis., has incorporated with $10,000 capital, to construct telephone exchanges and plants. L. E. Kerns, F. H. Ford and L. W. Kroncke are the incorporators.

J. W. Scriber, F. D. McCully and W. W. Hindman have incorporated a company at La Grande, Ore., to build telephone lines to Union and to Elgin, Ore. Their capital is $3,000.

Capt. Ira Harris was granted a telephone franchise at Superior, Wis., for 30 years for the Standard Telephone company.

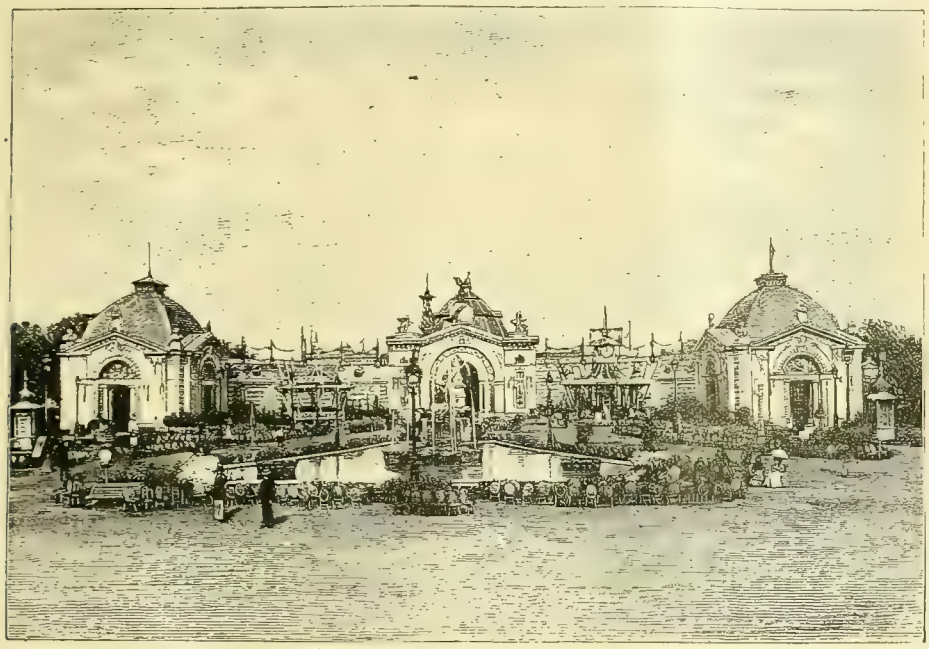


FIG. 1. BORDEAUX—ITS THIRTEENTH EXPOSITION—PRINCIPAL FACADE AND LUMINOUS FOUNTAINS FROM THE INSIDE LOCKING WEST.

## Petition for Injunction Against the Chicago Telephone Company.

A. S. White has commenced a fight in the Circuit Court against the Chicago Telephone company, attacking its right to erect poles upon Lake avenue in Hyde Park. Mr. White asks the court to enjoin the telephone company from maintaining tree trunks and telephone wires as well as conduit pipes in front of his house, Lake avenue, south of Thirty-ninth street. The complainant says his property is improved with a fine house, and that the wires and tree trunks which the company have erected are a nuisance. White adds that the wires constantly give out disagreeable noises, particularly in cold weather, which disturb his peace and quiet and that of his family.

The court is told that in the original title to the complainant's property the title to the westerly half of Lake avenue went with the property, consequently White claims that he is the owner of the fee in that portion of land in front of his house extending to the middle of the street, and owns the location where the defendant's poles are placed. For this reason the court is asked to interfere and cause the poles to be torn down.

## Chicago Telephone Company and Its Employes.

[From the *Chicago Chronicle*.]

The Chicago Telephone company now appears in the new role of a censor of morals. Some months ago it described the color of dress which might be worn by female employes. Now it prescribes the cut. The well-known moral sense of the telephone company is affronted and outraged by the spectacle of women clad in bloomers. It is one of the few instances in which the corporation has attempted to establish a regulation not intended either to reduce its expenses or to increase its profits. Corporation magnate get so in the habit of regulating matters for their employes and for the general public that it is not extraordinary to find some of them occasionally invading the domain of feminine dress, with impertinent regulation of matters which concern them not a whit.

FIG. 2. BORDEAUX—ITS THIRTEENTH EXPOSITION.—ELECTRICITY BUILDING ON THE RIGHT.

Western Electrician

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**CORRESPONDENCE** relating to electricity or any of its practical applications, is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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HIGH WATER MARK

CIRCULATION, 16,630.

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SERIOUS charges have been made by C. L. Bonney against the Chicago City Council, the Chicago City Railway company and the North and West Chicago Street Railroad companies. In a published interview it is asserted that many public documents, submitted to the council, have been suppressed, destroyed or lost in the interest of the corporations which dominate the board of aldermen. Mr. Bonney regards the city fathers as the hired men of the big railway companies and he does not hesitate to express his views on this subject in forcible language. He speaks as one familiar with the workings of the council and the methods in vogue at the city hall. We guess that the McGann-Bonney combination will make considerable trouble for the old companies unless a settlement is effected.

WE extend our congratulations to the people of Atlanta, the management of the exposition and the people of the South generally upon the success that has attended their efforts thus far, and we trust that the practical and substantial results of this great exhibition will be as valuable and far-reaching as our Southern neighbors anticipate. No doubt it will be the means of attracting much attention to that section of the country, and if it serves to awaken interest among northern capitalists in the resources of the Empire State of the South it will have amply repaid the good people of that section for the expenditure of labor, time and money which the exhibition entailed. There is an excellent field for electrical workers in the South, and we trust that it will receive due attention at the hands of the manufacturing and construction companies.

TEAMSTERS in Chicago do not appear to understand or appreciate the fact that there is a city ordinance providing for the punishment of those who wilfully obstruct street railway tracks. The little fellows, drivers of buggies and light wagons, generally make way for cable and motor cars, although when possible they annoy and delay the railway employes, but the drivers of heavy trucks and moving vans take advantage of their heavy structures being too strong for the motor or grip cars to wreck and defy the railway men to run into them. In such cases the street railway company should instruct its employes to cause the arrest of these drivers when practicable. A few examples of this kind would have a salutary effect upon these fellows. They fail to realize that their meanness affects the passengers on the street cars, not the operating company.

MANY interesting legal points have been raised in the actions for damages against street railway companies growing out of the new conditions that have been brought about by the introduction of electricity on surface lines. Here is a case reported in the daily papers of Rochester in which $10,000 is demanded of the local street railway company on account of an accident under the following circumstances: A man with a large basket had just stepped upon a Sophia street car, which, the complaint alleges, started at a rapid rate before the man had more than reached the step, so that his body and his burden extended several feet beyond the side of the car. The plaintiff was standing close to the car, waiting for it to pass and was knocked down by the body of the passenger and his basket, and was severely injured. It would seem that the complainant had no business to stand so close to a moving car, and that by so doing, he was guilty of carelessness, thus relieving the defendant of responsibility. A close observer in any large city will notice frequent examples tending to prove that many persons constantly invite injury from street cars and other moving vehicles in crowded streets. The public should learn to use a reasonable amount of caution in crossing streets and when boarding and alighting from street cars.

HEAVY damages are demanded of the Omaha Street Railway company for the destruction of the water pipes of the city, which, it is claimed, is due to electrolysis. On September 9th the Farmers' Loan & Trust company of New York, holding bonds of the Omaha Water company in the sum of $400,000, and E. L. Bierbower and A. B. Hunt, receivers, filed a suit in the United States Circuit Court against the Omaha Street Railway company asking for damages in the sum of $250,000. The petition alleges that the water company has already expended a large sum in replacing mains ruined by electric currents and is compelled to replace many more. The court is asked to require the street railway company to remove the cause of the trouble.

Here is a subject worthy of serious consideration, and it behooves street railway companies to meet the issue squarely and frankly. No better opportunity could be desired than that afforded by the convention of the American Street Railway association to discuss and dispose of this problem. Let the officers of that organization impress upon the street railway men of the country the importance of this subject and make its discussion the most prominent feature of the meeting, and there is no doubt that the attendance of practical men, those in charge of the operation and those furnishing the financial backing of the roads, will be much larger than it otherwise would. It is a matter of vital importance to the street railway interests of the country and should be given the attention that such a question requires.

DURING the last week the anti-Bell forces have decided upon a policy that will, it is believed, change the condition of affairs in the telephone field. Heretofore the American Bell Telephone company has assumed an aggressive attitude toward the smaller and weaker companies that have been endeavoring to gain a foothold, and it has succeeded not only in driving many companies out of the field, but it has by this policy kept other capital from investing. There can be no doubt that it was the intention of the Bell interests to continue this policy under the ruling of the United Court of Appeals in the Berliner case, and if any evidence is wanted in support of this statement it is furnished by the action of the Bell company in beginning proceedings against several companies which were not members of the American Telephone Protective association, and therefore could not claim the support of that organization. As the concerns attacked by the Bell company were not in a financial condition to stand the strain of a protracted legal controversy, it was believed that they would prove easy victims, even though they might make an honest effort to defend themselves. It will be seen that the Bell company's plans, well designed and carefully followed, seemed in a fair way of accomplishment when the further prosecution of these claims was stopped, temporarily at least, by the action of the law department at Washington. The government did not like the aspect of the case as it came from the Court of Appeals with Justice Putnam's curious opinion tacked on to it, and it did not take long to decide that the only course for the government was to bring the case before the Supreme Court of the United States for review. This had the effect of placing a check upon the Bell company and leaving the question of the legality of the issuance of the Berliner patent still undecided. At this point the anti-Bell companies stepped in and took up the fight. They decided to proceed against the American Bell Telephone company under the anti-trust laws, and they have enlisted the services of the United States district attorney at Chicago and the attorney-general of Illinois. The evidence in the case has been collected and carefully compiled by the American Telephone Protective association and has been placed at the disposal of the government.

OF special interest at this time is the paper on "Accumulator Traction," by Maurice Barnett, which appears on another page of this number. The fact that street railway men have been somewhat slow in seeing and taking advantage of the many excellent features of this method of propulsion has been a source of much annoyance to storage battery men, if indeed the failure of the public to reward their efforts has not discouraged some of them in their investigations. To this may be attributed in part the failure to fully develop the system. Much of the success of the trolley has been due to the energetic manner in which the details of the system have been worked out. While storage battery men were haggling over patents, promoters of trolley systems were overcoming the objections and difficulties with which they were beset in the early days. They succeeded in not only perfecting their apparatus, but placing it in actual operation, before the storage battery men began to realize the fact that they were affording their rivals an opportunity to gain control of the street railway business. Of late, it must be admitted, the promoters of the accumulator have changed their methods. They have very wisely transferred the scene of their active operations from the court room to the laboratory, with the result that since this change of policy was adopted more real advancement has been made than had marked their progress in several years. They have utilized the information obtained, putting it into practical application, and to-day they are in a position to present statistics as to the efficiency of the service that they are able to give. In the present paper, Mr. Barnett points out many advantages of the storage battery over the trolley, and his figures, if correct, show that marked advancement has been made. It is interesting to note that he does not give much serious consideration to the underground conduit system as a probable rival, assuming that the storage battery will be used wherever the overhead trolley will not be admitted. This assumption is evidently based upon the fact that the conduit system does not rank with the overhead in point of economy, and that all of the objections to the latter can be raised against the former with the single exception of possible danger due to the presence of the exposed overhead wires in case of fire. It is to be regretted that storage battery men continue to harp upon the "unsightly" and "deadly" wires of the overhead trolley system. They must know that these objections can be overcome, and that to-day there is no good excuse for their existence. They are a result of cheapness in construction, for which the operating company is largely, if not entirely, to blame. If such a company adopted the storage battery it would doubtless follow the same policy, and put in the cheapest form of construction obtainable, and this would naturally result in defects and disadvantages that might make it even less desirable than a cheap form of trolley equipment. By far the best policy to adopt in considering the relative merits of the several methods of propulsion and forms of equipment is to take the very best type of each as a standard and insist upon constructing as well as operating companies meeting this standard. The question is not how cheaply, but how well these roads can be built, and the very best service possible should form the standard upon which all estimates should be made.

Mr. Barnett's figures are based largely upon the results obtained in the storage battery lines in operation in Paris. This system was described and illustrated in the WESTERN ELECTRICIAN of June 22d, and the recent reports that have been received concerning the operation of these lines confirm the good impression made by the preliminary statement. Still better results are anticipated when the conditions are more favorable.

## Can I Get a Patent?[1]

By George P. Whittlesey.

This is usually the first question an inventor asks, when he has completed his model or experimental machine and finds that it works all right. To get an answer he writes to a patent attorney, enclosing a sketch or photograph of the invention, and a description of its construction, mode of operation and advantages. Perhaps I should reverse the order and put "advantages" first, because the average inventor gives more emphasis to that side of the question than to the others. The patent attorney, on the other hand, wants to know first of all what the machine does, and secondly, how it does it.

To a man not familiar with the United States Patent Office and its records, it seems a very simple matter to find out whether or not he can get a patent for his invention. He thinks all there is to do is to look at the patents for machines of that kind, and see if there are any like his own. In a certain sense this is all that need to be done. But to put the theory into practice is where the rub comes in, as in many other matters. A few facts and figures may be interesting to the readers of *Machinery*.

The United States patents are issued on Tuesday of each week. The average number issued weekly during the year 1894 was 382. In addition to these there were design patents, re-issues of patents previously granted, caveats, and trade-marks registered. The total for the year was 19,875 patents, 928 design patents, 64 re-issues, 2,286 caveats, and 1,806 trade-marks. These figures are somewhat below the average for several years.

The patent system was inaugurated in 1790. Up to July 28, 1836, the patents were not numbered. There were 9,957 granted during this period. Since the numbering began, on the date mentioned, there have been issued up to and including June 11, 1895, no less than 541,057 patents. Design patents began to be granted in 1843, and now number 24,395. The first trade-mark registered was in 1870, since which time 26,695 have been entered for record. There have been nearly 12,000 patents re-issued to correct inadvertencies, accidents or mistakes in the originals.

This vast mass of material is divided into 213 classes of invention, beginning with "Accoutrements" and ending with "Woodworking Tools." The largest class is carriages and wagons, with over 20,000 patents. The smallest is linotyping, with less than 100. Between these I find air and gas engines, 1,025; clutches, 1,535; conveyers, 1,167; cranes and derricks, 596; gas, 3,060; hardware making, 1,395; hoisting, 5,558; hydraulic engineering, 1,146; injectors and ejectors, 540; journal boxes, pulleys and shafting, 4,352; lubricators, 1,409; machine elements, 4,785; measuring instruments, 9,344; metal boring and drilling, 1,242; metal forging, 732; metal founding, 2,310; metallurgy, 4,685; metal punching and shearing, 1,056; metal rolling, 1,167; metal turning, planing and milling, 2,012; metal working-tools, 3,265; pumps, 4,240; railways and appliances (two classes), 23,808; steam boilers and furnaces, 8,830; steam engines, 8,237; steam engine valves, 2,465; wood turning, 756; wood-working machines, 5,524. These are the figures published by the Patent Office on January 1, 1895.

Each of the 213 classes is subdivided into subclasses, in all more than 8,300. For instance, class 136, steam engine valves, is arranged as follows:

| | |
|---|---|
| Balance slide— | Reversing. |
| Double. | Rotary. |
| Roller. | Safety. |
| Cut-off. | Slide. |
| Gauge-cocks. | Steam actuated. |
| Governor. | Throttle— |
| Piston. | Electric. |
| Puppet. | |

"Well," says the inventor, "that should make it a very simple matter to find out if I can get a patent. Just look at the proper subclass, and if you don't find my invention that settles it."

Unfortunately, it does not settle it. The patents are classified by arts; that is, all the patents for gauge-cocks, for instance, are supposed to be put together (I say "supposed," because there are some gauge-cock patents under other subclasses). But when a search is made to determine the patentability of an invention, it is not the art or the class, but the actual construction of the device which must be looked for. A search on a gauge-cock must be carried through not only that subclass, but also several subclasses of cocks and faucets under water distribution, and possibly into bottle taps, siphons and bottle stoppers.

A certain construction of axle skein required a search through axles, axle skeins, axle boxes, hubs, hub attaching devices, sand bands and wheels. An electrical branding iron was searched in branding stamps, electric body wear, electrodes, applications of electricity, electric heaters and thermocauters. A tape holder in clasps, spools, ticket reels, tape measures and packaging braid. An air-pump governor, in fluid pressure regulators for gas, water and steam, and speed governors. A blow-off cock in boiler attachments, boiler cleaners, flue and tubular boilers, manholes, safety devices and furnace attachments. A pocket axe in hammers and hatchets, knives, gauge knives, pocket knives, razors, making axes and hatchets, box scrapers, compound tools, scythes and erasers. An automatic rope clamp in hawser clamps, clothes-line fastenings, fire escapes, curtain-cord fixtures, hitching hosts, hitching straps, clasps, cleats and belaying pins.

These examples, taken at random from my note book, are sufficient to show that the official classification is not a safe guide in making a search. One must rely almost wholly upon his experience and his knowledge of the various arts, so that in hunting for any particular thing he may be sure to look in every place where it or something like it may be found. Even electrical devices are scattered all over the office, and one is not safe in confining himself to the two electrical divisions only.

There is another point which must be kept in mind by the searcher, and that is the mechanical equivalent of the thing he has in hand. This is a matter of patent law, and only those accustomed to patent practice are able to properly recognize the value, as a reference, of many a patent which to the untrained eye has no bearing whatever on the invention.

It will be seen, therefore, that a "preliminary examination" is a matter which takes not only time but skill and experience, and that it is not by any means the simple thing that it appears to be. And when you come to "validity searches," to determine the scope and value of a patent, there is demanded far greater ability and experience in the careful weighing of claims and specifications, the thorough examination of foreign patents, and the mass of printed publications stored in the government libraries. But of this I will not say more at present, my object being merely to give the readers of *Machinery* an idea of what it means to attempt to answer the question, Can I get a patent?

1. From *Machin ry*.

## Speed of the Baltimore & Ohio Electric Locomotive.

The Baltimore *Sun* gives the following interesting account of the recent speed test of the new electric locomotive used in the Baltimore & Ohio Railroad company's tunnel under Baltimore:

This record was made in the locomotive's first test of high speed through the tunnel. The electric giant carried on the trip Dr. Louis Duncan, consulting electrical engineer of the Baltimore & Ohio; W. D. Young, superintendent of the Baltimore & Ohio company's electric power house; L. H. Parker, supervising electrical engineer of the General Electric company, and F. H. Shepard, Mr. Parker's assistant. F. W. Murray, an old and trusted engineman of the Baltimore & Ohio, stood at the controller.

Approaching the south portal of the tunnel a speed of only 20 miles an hour was developed, owing to the curve and switches at that place. The start was made with an easy forward glide of the locomotive. Entering the tunnel the engineman twirled the wheel around, fixing the controller on speedier notches.

Under the impetus thus given the locomotive dashed forward. As steady as a palace car, owing to the absence of vibrating parts, it flew past the double row of electric lights which illuminate the tunnel, at a speed that seemed to blend their glimmer into trails of light stretching to the north opening of the tunnel. So smooth and steady was the motion that the rapid rate did not appear unusual. All on board kept firm grips on their hats, as the cool air of the tunnel whistled through the cab.

Engineer Shepard stood at the speed recording apparatus, watching the movements of the instrument. Nearing the northern portal of the tunnel the power was shut off and the speed was reduced. The announcement was then made that an actual speed of 61 miles an hour had been attained. A smile of intense satisfaction overspread the countenances of the electrical experts at this result, and Dr. Duncan expressed himself as greatly pleased with the test.

Much interest was manifested in the performance of the flexible trolley during the trial. This feature of the electric locomotive has attracted general attention, and many queries have been made as to its adaptability for even ordinary service, not to speak of fast speed trials. The trolley mechanism was closely watched during the trip, and at the speed maintained it took the irregularities of the overhead structure with apparent perfection, there being not the slightest hitch or jar in its operation. The trolley shoe glided with remarkable precision through the electric conduit, at one moment bringing out the full extension of the flexible shaft, then dipping down to within a few feet of the locomotive, running on one side and then on the other, and not a single spark or sputter was to be observed.

When the locomotive was first tried with heavy service trouble was encountered owing to the heating of the trolley shoe. This was due to the fact that the overhead conductor had been in position for some time, and not having been used, an accumulation of scale had developed, impairing the contact of the trolley shoe. No further trouble has been found since this scale was removed, and a recurrence of the difficulty is not expected.

The burst of speed resulting in the development of a rate of 61 miles an hour was made on the heavy grade of the tunnel, and the engineers said it was equivalent to 75 miles an hour on a level track. The performance of the locomotive was such that they would not hesitate to run it at that or even a greater speed if they had a sufficient stretch of track for the purpose. Locomotive No. 1 was not designed for fast time, and the result of its latest test is looked upon as an indication of what may be expected from an electric locomotive specially designed for such a purpose.

Since August 4th locomotive No. 1 has been hauling the entire freight service of the B. & O. through the tunnel, and it has been daily ready for operation every hour of the 24. The average speed maintained in hauling heavy freights has been 15 miles an hour. Two more of the locomotives are now in progress of erection at Schenectady, N. Y., where the works of the General Electric company are situated, and in a few weeks both of these will be brought to Baltimore for service.

The original plans for the overhead structure in the tunnel and for the locomotives have been adhered to, and Engineer Parker stated that no departure from them is contemplated.

A large number of railroad officers and electrical engineers from other cities have been inspecting the new service in the tunnel, and it is now generally regarded as a practical success. Arrangements are being made for a visit to Baltimore of a delegation from St. Louis, including the officers of the Terminal association of that city. The object of the trip is to study the operations of the tunnel equipment here with a view of installing such a plant in St. Louis for hauling trains through the long tunnel entering that city.

It is stated that the management of the Second avenue electric line in Pittsburg contemplates the expenditure of $1,000,000 in extending its road through adjacent towns to Brownsville and ultimately to Wheeling, W. Va.

## Brussels Street Railways

The electric street car, according to the Brussels *Petit Bleu*, has invaded Europe, the first wheel turning before an "astonished and pleased audience" lining the route through that city. The new car appeared on the streets of Brussels at nine o'clock one Sunday morning. The mastodontic (see Emerson) train, as the local papers call it, "is furnished with elegant curtains," and has "nine transverse seats and two platforms," making places for 50 passengers.

The step was a result of necessity. The increase in patronage rendered it imperative that double the capacity of the old style horse cars be provided at once in order to accommodate the patrons.

A curious fact greets the American in Europe who undertakes to board a loaded street car. There is over the rear door a little sign which, on such occasions, is the bane of the pedestrian from Chicago. It says "complet," which is a French way of saying "full," and it is a penal offense for the conductor to allow more persons on the car than are arranged for and after he has displayed the sign. This much by way of explanation.

The Frenchman or the Belgian is nothing if not economical, and it needed only kindergarten arithmetic to show that two cars required more employés than one, more horse power and more material. It was a Gordian question, and, according to a Brussels daily, required a serious conference of the officials, three engineers and a shop superintendent, to settle the matter; and now the native city of that electrical engineer who did more for electric railways than any other, living or dead—Chas. J. Vanderpoel—has unwittingly erected a lasting monument to the fame of the great inventor.

## Goubet Submarine Boat.

A submarine boat of the Goubet type has just been completed in Paris for the Brazilian government at a cost of 250,000 francs. After the final tests of the boat have been made on the Seine she will be forwarded by rail to Toulon, where she will be shipped on board an ironclad for Rio de Janeiro. Experiments with the Goubet boats have proved conclusively that they are habitable by a crew. The supply of fresh air on the boat is renewed from reservoir tubes of oxygen and the vitiated air is forced downward into the sea by pumps which work automatically. The crew will consist of an officer and two men, who can without difficulty remain under water for 15 hours. The craft is eight meters in length and 1¾ meters in diameter in the center, and is pointed at the ends; her shape is that of a cigar. The hull is of gun bronze and is cast in three sections, which are screwed together from within. The boat is fitted with an electric motor of two horse power, which will enable her to make eight knots an hour. She is also furnished with oars, similar in shape to a duck's feet, by means of which she can be rowed in any direction in case of accident to her machinery. The absolute security of those on board is secured by a safety weight of 1,200 kilogrammes fastened under her keel, the unscrewing of which will cause the boat to rise to the surface of the water like a cork. She can be made to sink to any depth or to rise by taking in or expelling water ballast. The usual depth to which she is regulated to sink is about four meters. She can be steered either by her screw or her rudder. A vertical telescope enables those on board to take their bearings. Automatic torpedoes can be released at any depth, obviating the plunging and lurching which attends the launching of torpedoes by the ordinary method. Boats of the Goubet type can be used in finding dormant torpedoes or to cut the wires by means of which torpedoes are to be exploded.

## American and English Electrical Work.

Americans are singularly free from obligations to English electrical practice. No doubt the widely differing conditions that exist in the two countries are to some extent responsible for this, but there is not the spontaneous recognition of English developments that we sometimes think is deserved. English electrical men were interested in the introduction of rectifiers on alternating current circuits, but electrical opinion in the States was very little stirred by the radical departure. The success of our overhead electric railway, though of vital importance to American cities, was not permitted to elevate the feelings of the American railroad man. It is some satisfaction to think, however, that the Liverpool overhead railway must have had some influence on the promotors of the new Chicago elevated electric railway, with its many miles of track and its 6,000 horse power electrical plant. In certain departments in central station practice, Americans have had enormous opportunities, but in some branches, mainly in the use of accumulators, we can, perhaps, teach them something. We are not led to say this from egotism, because though it is difficult to directly trace the results of American practice on English work, we are very much indebted to it. American experience taught us very early to avoid certain methods if we would achieve success. In the industrial applications of electricity we can still learn much from what is being done in America. If we could closely follow them in the almost universal use of the electric motor, the English electrical industry would flourish like the green bay tree, while the extension of central stations to small towns and villages would result in most material advantage both to the industry and to the public.—*Electrical Review*, London.

## New York's Greeting to Telegraphers.

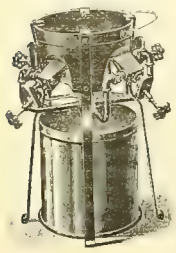
[From the *New York Herald*.]

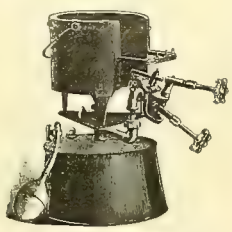
New York is as much to be congratulated as the United States Telegraph Corps and the Old Time Telegraphers' association on the choice of this city as their place of meeting. The men who have their fingers literally upon the pulses of commerce and the secrets of the nation are those who sit hour after hour at the telegraphic keys and transmit the messages of good or ill along the maze of wires that has bound this country in a net which can nevermore be broken.

Of all the representatives of various industries, of trades,

professions or any branch of human activity there are none who are more intelligently active for the good of civilization than these men whose lives are bound up in the development of the facility of communication of thought. Time and distance have been overcome by them, and now they have but to consider the simplification of the methods of transmission. With such men as these who are at present enjoying themselves there can be no question that the hour, if not yet come, is almost struck. When it does arrive then these practical telegraphers will take up some newer branch of endeavor and carry it to perfection, as they have so many others.

That they are welcome there is no doubt in their minds or in those of the citizens of this metropolis. It is to them as much as it is to any class of persons that this city owes its prosperity and its wonderful growth, for it is to them that are due the facilities of electrical communication which have





FIGS. 1 AND 2. RAILWAY CONSTRUCTION SPECIALTIES.

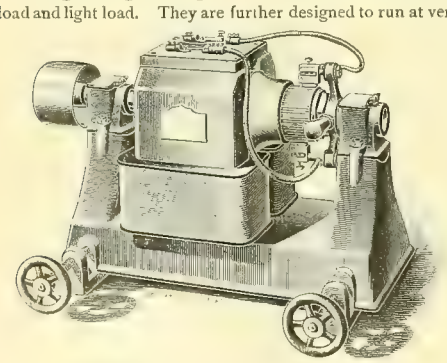
permitted New York to retain its rank as the metropolis of the United States.

## Railway Construction Specialties.

In the accompanying cuts are shown two specialties that are being placed on the market by the Union Heater Supply company of Detroit. They are used not only in outdoor work, such as line construction, but they will be found convenient and efficient in the repair shop. Fig. 1 shows what is known as the No. 4 helper, which is made to melt metal in larger quantities than with the ordinary fire-pot, and will take in an eight-inch metal pot. It has four burners mounted on flexible joints, which can be operated separately or together. The hood can be removed by simply slacking back on a thumb screw, leaving the burners (which are attached to a heavy brass tank) open to use for dressing light tools and tempering. It is used for construction work, and is simple and durable, and has no parts that will easily wear out. Its weight is 22 pounds. Fig. 2, the "lineman's firepot," has already become recognized as a standard device by construction companies.

## Quaker City Dynamo and Motor.

The cut illustrates the new dynamo and motor just brought out by the Quaker City Electric company of Philadelphia. This machine has been designed to meet the demand for a high grade machine for isolated lighting plants at a low cost. The frame is made of cast-steel, the commutator of tempered copper, and the insulation and other materials used throughout in the construction of the machine are of the best quality suited to the purpose. The improved self-feeding brush-holder permits the machine to be reversed, a most desirable feature for elevator motors. These machines, at present built in sizes ranging up to 25 kilowatts, are provided with self-oiling bearings and regulate automatically between full load and light load. They are further designed to run at very



QUAKER CITY DYNAMO AND MOTOR.

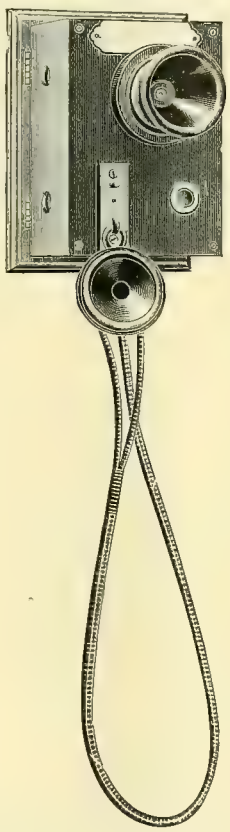
moderate speed, and for efficiency, regulation, simplicity and completeness are unsurpassed.

## The M. & B. Telephone in the Manufacturers' Club, Philadelphia.

Since the United States Telephone Construction company has had the M. & B. telephone on the market it has produced a good many designs and instruments for interior use. The accompanying illustration shows one type known as style E, which is in use in the Manufacturers' Club, Philadelphia. This club has recently acquired property adjoining the club house and fitted it up into parlors and bachelors' apartments. There are 17 rooms each of which is supplied with one of these telephones. In the cashier's office down stairs there is a needle annunciator manufactured by the Partrick & Carter company, to which are added telephone connections and a fire alarm system. In each of the style E telephones is placed a fire alarm bell. The telephone measures 4½ by 6½ and is 3½ inches deep. It is made of polished oak, finished with a black rubber face and nickel trimmings. All the batteries are in the basement, and the system is so arranged that any of the rooms can communicate with the office, or intercommunication can be effected between any points desired. The annunciator is in the hallway by the cashier's desk, where there is always some one in attendance. The service given by this arrangement is extremely satisfactory, and combining as it does a fire-alarm system with the telephone system, makes it doubly valuable. In case fire should be discovered, any employe can go to the annunciator, open a little door in front and pull out a plug which releases the clockwork mechanism and starts the fire-alarm going. This rings all the bells throughout the house, so that the system insures both convenience and safety to the occupants of the club.

## Automatic Safety Limit Switch and Rheostat for Starting Stationary Motors.

The value of a complete device, such as is shown by the accompanying cuts, and manufactured by the Card Elec-



THE M. & B. TELEPHONE IN THE MANUFACTURERS' CLUB, PHILADELPHIA.

tric company of Mansfield, O., is certainly great. Fig. 1 illustrates the new safety limit switch and rheostat for starting stationary motors, and is not only a safeguard against damage to the motor from open circuits on the line while the motor is running, but is also reliable as a limit switch and may be adjusted for any percentage of overload desired. The principal operating parts consist of two bar electro-magnets in circuit with the line armature, a double-pole switch with spring release, a resistance contact arm held normally at "off" by a flat coil spring, and the usual contact points and building blocks.

Aside from the general excellence in design and construction of this starting box, its principal novelty lies in the arrangement of parts constituting the magnetic circuit. The two bar electro-magnets operating the releasing mechanism are provided with pivoted armatures at each end, common to both, the lower one acting as a yoke when closed, forming with the two cores a simple horseshoe magnet; this armature or yoke is, however, so pivoted that should the current for any cause cease to flow through the line while the motor is running, the spring provided for throwing the double-pole switch will instantly be released, and, tripping in turn a catch holding the swinging arm, that will be thrown "off" over the contact points, cutting the resistance in and placing all parts of the apparatus in proper position for starting again. An overload pulls the upper armature down, releasing the detent holding the switch closed, and that, with the swinging arm, is instantly thrown to "off" the same as for no current.

The magnets of this switch differ from other automatic switches in having but one coil of heavy wire of few turns, carrying the full current of the motor. There are no fine wire coils or differential windings to give trouble and cause unreliable action. The work of releasing the catches is done direct and in the simplest possible manner, and is so divided in the mechanism that failure to act is said to be impossible. The lower pivoted armature releases the

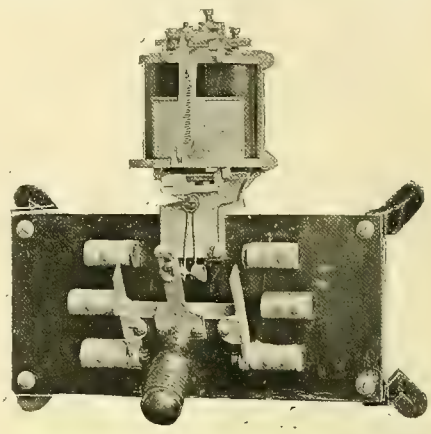


FIG. 2. AUTOMATIC SAFETY LIMIT SWITCH AND RHEOSTAT FOR STARTING STATIONARY MOTORS.

switch for "no current" and the upper armature for "overload." The adjustment of one does not in any way affect the other.

Fig. 2 illustrates the Card automatic safety and limit switch designed to use with motors not provided with a safety switch, thereby saving the user the cost of a new rheostat. This is done by simply changing the connection of wires between the starting box and motor to the switch, and operates in every way the same as the Card combined switch and rheostat, as illustrated in Fig. 1.

When the current for any cause ceases to flow, the switch will automatically open, and also if the motor is overloaded more than is provided for in the adjustment of the spring holding the upper armature off the magnets. Where old-style starting boxes are used it is necessary to look after an overload, and is usually done by inserting in the circuit near the motor pieces of fusible metal supposed to have a certain carrying capacity at which they will melt, thereby opening

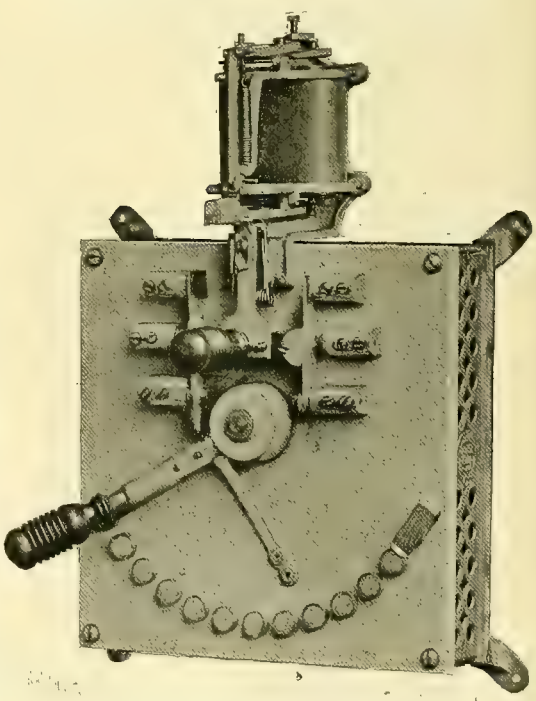


FIG. 1. AUTOMATIC SAFETY LIMIT SWITCH AND RHEOSTAT FOR STARTING STATIONARY MOTORS.

the circuit. The result often is, if the fuse is just suited to the motor and a temporary overload happens a few times, blowing it out, the trouble of putting in a new one will tempt the attendant to put in one of twice the carrying capacity necessary, or, as is often the case, a piece of wire or other metal, so that the motor has no protection at all. Again, fuse metals are not always reliable, since it is hard to get two pieces that will melt at the same temperature; and if they do, the time taken to fuse them may, with a heavy

current, affect the armature seriously. By using the Card switch there is no danger of injury to the armature because of overloads, since it can be depended upon to act every time and act promptly.

The following claims are made for the Card automatic starting boxes: First, they will prevent excessive overload on the motor at starting, caused by cutting out the resistance too fast; second, they will open the motor circuit and cut in the resistance instantly, if the generator stops or the line is opened; third, they will open the circuit and cut in the resistance if a load is put on the motor in excess of the limit for which the regulating spring is set for; fourth, they will open the circuit and cut in the resistance if the belt breaks or is thrown off; fifth, they will prevent the starting of the motor in any but a safe and proper manner, and will take care of it while running, better than any attendant can, and much quicker; sixth, they are complete, reliable, durable and ornamental.

## The Warren Alternator.

Advancement is being constantly made in details of construction and simplification of form in alternating current machinery, and this idea has governed the designers of the apparatus herewith illustrated. In the construction of the Warren alternate current generator, the aim has been to embody in the simplest possible form of construction, all of the most advanced ideas in the generation of alternating current. The fundamental idea has been to secure a machine of perfect electrical and mechanical balance, of highest possible efficiency and regulation, and, withal, a machine that will not burn out or require costly repairs—a machine which, aside from a due regard to lubrication, may be put into the most severe service and left to run perpetually without attention of any sort; a dynamo of slow speed and low frequency, which meets all the conditions of the best of the well-known types of alternators, but from which all hazard is eliminated; in a word, a machine built to earn money with, instead of spending money upon.

In designing the Warren alternator, the great consideration being simplicity and durability, the so-called inductor type of machine has been adopted. In working out the new design founded on this principle, excellent results have been attained—exceptionally close regulation and high efficiency (only one-half of 1 per cent. of kilowatt capacity for excitation), smooth and noiseless running; no heating of any part, consequently no waste of energy.

Its construction is such as to permit of various ways of connecting for different voltages without in any manner changing the machine or requiring new coils. It may be connected for a 110 or 220 volt system, and used without transformers for short distances, or for 1,000 or 2,000 volts to be used with transformers for long-distance transmission; or it may be connected to operate a 110 volt circuit and a 1,000 volt circuit both at the same time. Its low frequency, 7,200 per minute, adapts it to operate arc lamps to greatest advantage and with perfect freedom from the hissing and humming noise at the lamp, so noticeable from alternating currents of the usual high frequency. The machine has no collector rings or commutator, brushes or moving wires, and there is no liability to burn out. It is built wholly of steel in all its magnetic parts; it is massive and heavy, but extremely compact, made for continuous runs without attention, and proportioned to run up to an enormous overload without wasting energy in heating any part.

The manufacturers will insure it against burn-outs (other than lightning discharges) for one-half of 1 per cent. on the purchase price per annum.

The armature coils being attached to the stationary removable laminated ring, which fits accurately into the bell-shaped steel frame, and exciting coil being attached to the steel frame, none of the coils being attached to any movable part, it is clear that no brush or sliding contact is required.

The revolving part consists of a cast-steel cylinder, on which is pressed laminæ that form the rotary poles; thus constructed, the revolving portion of the machine is simply a solid mass of steel, through the polar projections of which the magnetic flux is delivered to the opposite poles of the laminated annulus to which the coils are attached. In other words, the rotor is simply the core of a magnetic field—the rotating flux path. It is made to fill the opening in the closed end of the frame shell so closely, and the polar projections move so extremely close to the poles of the annulus, as to diminish the air gap reluctance to the smallest conceivable fraction, as shown by the fact that less than half of 1 per cent. of the kilowatt capacity of the machine is required for excitation.

The armature coils, as shown, are wound on forms; are small, and being attached to the stationary removable ring, are easily replaced in case of an injury from a lightning discharge or accident. The cost of these coils is quite insignificant, only about three dollars each. The large coil shown in the cut is the exciting coil, there being but one, and it also being stationary, the extreme simplicity of the electrical features of the machine is apparent. The whole being composed of laminated parts and cast-steel correctly proportioned, no heating is developed, even when running greatly overloaded.

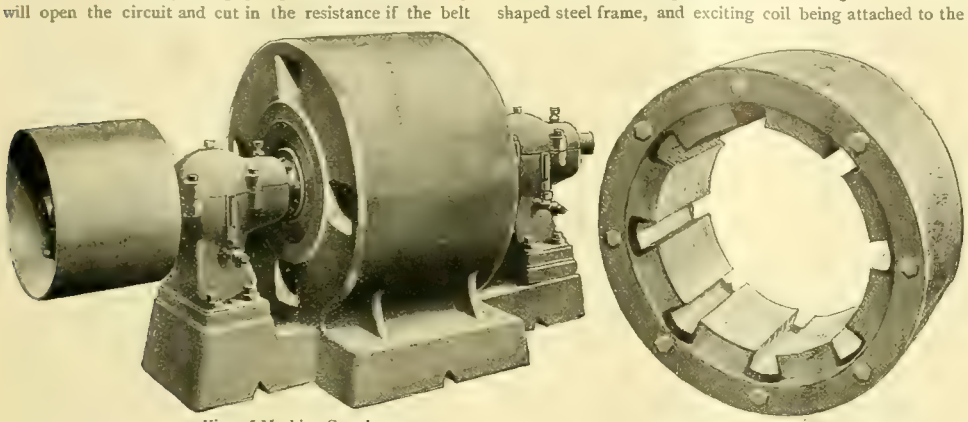
The mechanical features of the Warren alternator have had most careful consideration. The exceptionally long self-aligning and self-oiling bearings, carrying a forged steel shaft of great diameter, permits running the rotor at the least possible clearance from the stationary parts, thereby reducing the reluctance due to air gap to the merest fraction. The 40 and 60 kilowatt machines will be built as shown in the accompanying illustrations, frame cast of steel in one piece, making the most compact and durable form of construction known. In larger sizes the upper half will be cast separate and bolted to the lower half in the usual manner.

No attempt is made at ornamentation for the purpose of handsome effect. Everything possible has been done for reliability, durability, ease of management and efficiency—everything to avoid burn-outs, repairs and excessive cost of operation. The machine is, however, pleasing in appearance and impresses a thoughtful person of its solidity, simplicity and adaptation to the most severe and exacting service.

The designers of this machine, C. C. Warren and H. B. Warren, having been pioneers in the practical every-day features of the electrical business, they have, they claim, been long since made painfully aware of the limitations of alternators of the past, with their delicate and costly parts, their revolving wire-covered armatures, their collector rings and brushes and arbitrary single voltage service, set out to design a machine better adapted to earn money with, and less so for the purchaser to spend money upon for repairs, etc.

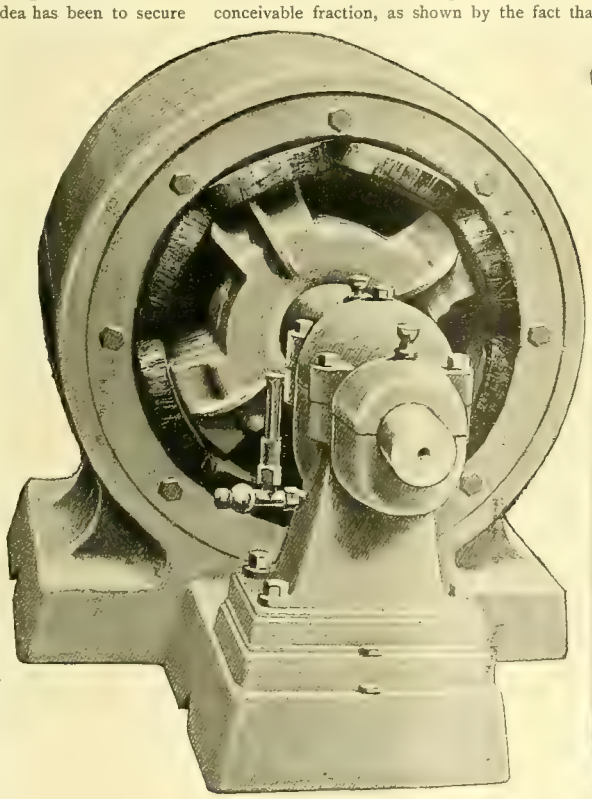
The standard frequency will be 7,200 alternations per minute at rated speed, but will be built for any frequency or speed desired.

Its unique construction is such as to make it especially adapted to connecting directly to any engine for any speed.

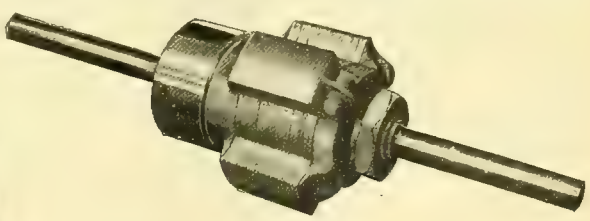


View of Machine Complete. Stationary, Removable Laminated Ring.

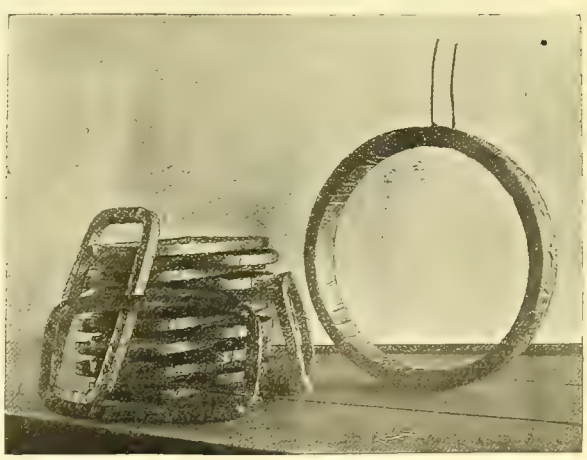
THE WARREN ALTENATOR.



End View of Machine.



Rotating Magnetic Core.



Armature Coils and Exiting Coil.

THE WARREN ALTERNATOR.

## Medbery Material as an Insulator in Electric Railway Work.

By W. R. Mason.

The extensive use of the Medbery material for insulating purposes in electric railway work dates back some five years. Because of its well-known insulating and its absolutely weather-proof qualities, as well as from its great strength, the Medbery material had been used as an ingredient in different compounds and for different purposes. Its superiority in such cases being recognized, it was naturally thought that it would stand the severe conditions of our climate and also the wear incident to electric railway service. Its use by a large number of the leading traction companies has proven the wisdom of such selection.

The necessity for exceedingly high insulating qualities, as well as fine texture in railway fixtures, is apparent when the large number used upon a road is taken into consideration. The leakage from a single fixture may be insignificant, but, multiplied through a line of several miles, becomes a serious loss.

So far, therefore, as insulation was concerned, the early styles of insulating material were all that could be desired, but they still lacked sufficient strength to be long-wearing under the trying conditions of line service. It was also found that many of these earlier styles of insulators, while showing good results in testing, were, however, unable to stand the climatic changes of heat, cold, rain, snow, etc. Attention was immediately given by a company to correcting these defects by special processes, and satisfactory results were obtained. The Medbery material was of such an extraordinary degree of hardness as to withstand the most severe service, while showing insulating qualities superior to any other material used for such purposes. The lack of certain desirable qualities in the earlier insulators has led to experiments with many other substances, and these will be continued as long as improvement will result. Thus far no one insulator has embodied all the desirable qualities found in the Medbery insulators, which have been in use on scores of roads for several years. Many compositions have been used and successively discarded during the time that "Medbery" has been held in favor by railway managers and superintendents. This has not been due to the disproportionately energetic push of the company in exploiting its material, for the sale of the different compositions which have been successively before the trade during the last few years has been engineered with zeal and a conscientious belief, however mistaken, that each was a substantial improvement over other material used. But from the introduction to the trade of the Medbery it has been used because of its inherent merit. It has proven its value as an insulator for railway service of extraordinary efficiency. And this involves not only its power as an insulator to withstand any current used and under all conditions, but also its toughness and hardness to endure the changes of heat and cold and the effect of rain, snow, sleet and ice. Hundreds of tests have been made to determine its efficiency under all adverse conditions, and it is surprising to note its unaltered efficiency in all circumstances.

An important point to be noticed is the reliability of the Medbery material as an insulator. It is a fact, though not always one easy of explanation, that insulators have been manufactured of certain compositions, some of which were of excellent efficiency and others were found to vary considerably from a proper standard of efficiency This fault of varying efficiency has not troubled the users of Medbery material. It has been put to the severest tests for a number of years and has shown itself constant in its high insulating qualities. This is undoubtedly due to its simple composition.

It is well in considering the necessity for hardness and toughness of insulators for electric railway work to observe more explicitly the reasons for those qualities. It must of course be impervious to water, or it might soon become useless as an insulator. It must be of closest texture and greatest strength in order to endure the more or less frequent blows of trolley wheels and poles. A slightly brittle substance soon chips away, and makes a renewal of insulators often necessary. This same strength is necessary to bear the building strains of the line. For, it is in almost all cases a key to the construction as well as an insulator, and failing in its office in any particular impairs the efficiency of the whole line. For this reason, glass—so serviceable as an insulator in telephone and telegraph work—cannot be used to advantage on railway lines.

To produce a substance of highest insulating qualities, not affected by weather changes, strong enough to bear the strains of construction and neat enough in appearance to do away, as far as possible, to the objections to overhead work, was not an easy task, but the Medbery material, by long service, has demonstrated its high efficiency in all respects and all conditions. A reference to many of the early roads equipped with this material almost justifies the belief that the material is indestructible.

As a proof of the high standard the Medbery has reached, it is enough to cite the cases of many railway managers who, striving intelligently to reduce expenses, have tried the frequently appearing new insulators, only to decide finally in favor of the Medbery as the best. Some one feature may strike the fancy and reason in a new pattern, but when one quality is prominent, others seem to be lacking. The widespread use of Medbery insulators to-day seems to indicate that all the desirable qualities of a railway insulator come nearest to perfection in it, and its merit is not based upon theory now, but upon the practical recommendation of scores, even hundreds, of railway managers—its use by them on their lines.

# CORRESPONDENCE.

## New York Notes.

NEW YORK, September 14.—It is reported that another storage battery traction trial is to be made in this city, this time on St. Nicholas avenue. It is said that the system previously tested on Ninth avenue will be used.

At Tuesday's meeting of the Brooklyn bridge trustees Mr. Page gave his colleagues something of a start by introducing a resolution providing for the introduction of electricity as a motive power for the bridge locomotives. The matter was referred without debate to Chief Engineer Martin, who will probably be called upon to make a report at an early meeting. There is alleged to be a growing feeling in favor of substituting electricity for steam as far as possible on the bridge.

The three days' reunion of the United States Military Telegraph Corps and the Old Time Telegraphers' and Historical association was held this week in the Broadway Central hotel. The reunion brought together about 500 persons. President Edward C. Cockey, the general purchasing agent for the Western Union company, presided. Mayor Strong, in behalf of the city, made an address of welcome. The election of officers resulted: S. A. Duncan of Pittsburg, Pa., president; J. D. Flynn of Pittsburg, Pa., vice-president, and secretary and treasurer, W. J. Dealy of New York. Pittsburg, Pa., was selected as the place for the next convention. The visitors spent much time in sight-seeing.

A curious case of death from lightning discharge is reported by Coroner's Physician Donlin in the case of Mrs. Juliet Albert, who was killed at her home at High Island, near City Island, last Wednesday. He found that the lightning had been attracted by a pin which Mrs. Albert wore in the neck of her dress. The lightning struck the point of the pin, melted it, and drove it through her dress, embedding it in her flesh. The skin around the pin was scorched. There were no other marks on the body. Mrs. Albert was sitting on a piazza when the lightning struck her. It went from her body to a wire on the wall, and demolished various articles in a room to which the wire led. The pin which the lightning first struck contained a large percentage of copper.

The underground trolley is to be used by the Third Avenue Railroad company on a short extension of the cable road in Amsterdam avenue, from One Hundred and Eighty-fifth street to One Hundred and Ninety-fifth street, as an experiment during the coming winter. A similar experiment is being tried by the Metropolitan Traction company. Railroad experts have declared that it would be easy to transform a cable road into an electrical railway and have the trolleys run in the conduits where the cable now runs. The half-mile of railroad in Amsterdam avenue, north of One Hundred and Eighty-fifth street, has been constructed like a cable road, but into the conduits will be placed electrical conductors instead of a cable. If the experiment is satisfactory during the winter the Third Avenue Railroad company probably will change from the cable to electricity along the entire line in Amsterdam avenue and One Hundred and Twenty-fifth street, and later in Third avenue and the Bowery. The underground trolley has several advantages over the cable, as it enables the cars to run backward and forward on the same tracks and to go slowly around curves. Electricity is cheaper as a motive power also.

The Consolidated Traction company of New Jersey has been cutting down the passenger traffic of the Central Railroad of New Jersey, between Newark and Elizabeth, by carrying passengers between the two places and return for 20 cents. It is reported that the Central will materially reduce its excursion rates of 25 cents between the two places, and extend the reduced rates even to this city. At the office of the general passenger agent of the road it was acknowledged that the Central's passenger traffic had been cut in upon by the trolley, but it was said that there would be no reduction of fares. W. F. O.

## Buffalo and Niagara Falls.

BUFFALO, September 14—As noted in this correspondence last week, the Niagara Falls Power company has refused to accept the Buffalo franchise outlined by the committee of city authorities. The mayor's advisory committee now meets Mr. Rankine's objections, in order, as follows:

First—The Niagara Falls Power company objects to the second clause, which requires any company accepting the grant to construct and maintain poles and conduits (not including short lateral lines) of sufficient capacity for at least two other companies requiring as great facilities as the company receiving the grant, besides affording space for eight public city wires, for which no charge is to be made to the city. The clause provides that any other company using this space must pay compensation for it, but the city to use it free of charge any time. Mr. Rankine says that in the ordinary course the company would build a line or conduit twice the capacity required for its own first use, in order to provide for its increased demands, and that this provision would require it to make accommodations six times what is now required for its own special use. He further says that his company would be willing to accept a provision requiring it to construct its poles and its main conduits with a capacity sufficient for the use of one other company, instead of two other companies, and also sufficient for the city's free use (we suppose refering to the eight city wires), provided that the other company use the same within five years from construction, upon payment of a proportionate part of the cost thereof, including interest, this right in any other company to lapse after five years, and it being understood that similar conditions will be annexed to any such grant made to any other company.

We think that this modification of the proposed grant would be a reasonable one, except that the period of five years is too short. The limitation of time should be made not less than eight or 10 years and further modified as below suggested.

The object of requiring poles and conduits to be built of sufficient size for the use of other companies is to keep the door open for compe ition in this business of furnishing electric power and to avoid the necessity of tearing up the same streets for other companies; otherwise the expense of erecting poles and building conduits of such a capacity would be unwarranted. We think it is sufficient to provide in this way for one competing company on each line of streets, in addition to the city's public wires We also think that the suggestion that the competing company should pay a proportionate part of the cost of poles or conduits (instead of being merely required to pay "compensation") is not an unfair one, as the company accepting the grant is required to maintain them in good condition, and is especially required to change and improve its method of construction and its plants at any time when it can be so improved, upon demand of the city government. If the city ever wishes to use this space for electric power purposes, in competition with the company, we do not see why the city should not pay for it on the same basis that any other competitor would.

As to the limitation of time, if no competing company appears on the scene, say within eight or 10 years, it would be unreasonable to prohibit the Niagara Falls Power company from using the vacant space on its own conduits or its own poles; but the grant should be so drawn that even after this time expires a competing company should have the right to use any space which the Niagara Falls Power company is not actually and necessarily using.

Second—The sixth clause is objected to because it requires that all wires shall be placed underground and all poles shall be removed within such reasonable time as the Board of Public Works, with the approval of the Common Council, may require. The Niagara Falls Power company suggests that all rights would be sufficiently protected by a condition that it should remove any such line on one year's notice. It seems to us reasonable that the grant should contain some such limitation of time, but in phraseology it should be made more specific. The company should be required to begin the work of removal and placing its wires underground within a certain time, and to complete it within a certain time, say to begin within six or eight months and to complete it within a year.

Third—The company objects to the ninth clause because it imposes a charge of 5 per cent. on the gross receipts of the company from the date of the acceptance of the franchise. It suggests that either the charge be remitted for the first five years of the franchise or the charge be limited to all power delivered after the first 10,000 horse power. The suggestion in regard to this charge upon gross receipts came from your committee, and it was our proposition that the charge be imposed as a graded charge, beginning with the second 10,000 horse power. The reason for this was that, according to our information, until at least 10,000 horse power is sold by the company, that they will not pay their interest and operating expenses. If so, they will only begin to make any profits on such power as they can dispose of after the first 10,000 horse power, and this proposition is really based upon the idea that the city should share in the profits of the enterprise, though the share of the city is measured by the gross receipts rather than by the net receipts or profits.

We are still of the opinion that it would be wise to remit the charge on the first 10,000 horse power, or as an alternative, that it would be proper to remit all charge whatsoever for the first five years. There is something to be said in favor of each of these methods of settling this matter, and we do not assume to say which is the better one.

A serious argument can be made and has been made by some of our citizens against this idea of imposing charge on the receipts of the power companies. It is quite probable that the amount of this charge, or a part of it, will be added to the price of the company to its consumers for power, and if so, it will operate as a tax on the consumers of the power for the benefit of the city at large. We can see nothing unjust in such a tax; on the contrary, it seems to be quite justifiable, as the city furnishes a considerable part of the plant, viz., the right of way through the streets. Whether the charge will prove to be a judicious one only the future can disclose. If it does not, it will be easy for the city at any time to remit the charge in whole or in part, on condition that the prices for power are correspondingly reduced.

Fourth—The company objects to the 11th clause of the grant limiting the franchise to a period of 25 years, and states that no franchise could be accepted for a period for less than 36 years, the term of the company's bonds.

This statement has been made before by the representatives of the company, orally and in print, so that it is not a surprise to anyone.

The original suggestion of the advisory committee to the Common Council committee upon this subject, which was made on April 2d, was as follows:

"The grant of any franchise should be limited in time, within reasonable limits and with provisions that at the expiration of the term the city shall either buy the plant at a price to be agreed upon or to be appraised, or shall grant

a renewal on terms to be agreed upon or to be appraised."

The idea of securing the city the privilege of buying the plant now seems to have been abandoned. In regard to the length of the franchise, we do not think it wise to make a grant for so long a time as 30 years, where so many unknown conditions are involved and so much uncertainty exists, without reserving some means by which necessary and proper modifications of the grant can be made within that period, especially in regard to the compensation which the company be required to pay to the city, by way of percentage on its gross receipts. The amount fixed in the grant may prove to be altogether too high or too low, and may require readjustment before 36 years has elapsed.

We have repeatedly suggested that the grant might be properly made for 36 years, with a provision for readjustment of its terms, especially in regard to compensation, at the end of 18 years, or, what is substantially the same thing, that the grant might be made for 18 or 20 years, with a provision for a renewal of the grant at the request of the company for a like period, upon such readjustment of its terms, especially of the compensation. The readjustment should not be made by the Common Council or by any representative of the city, which is one party to the contract, but by a fair judicial tribunal—that is, a board of arbitrators selected in the usual manner. We are still of the opinion that such a provision as this ought to be satisfactory to the company, as well as to the city, and to this extent we think that the request of the company that the term of the franchise be extended beyond 25 years should not be granted.

There would be no objections to a second renewal with such judicial readjustment of the terms of the grant.

Fifth—The Niagara Falls Power company objects to the 14th clause of the grant, which reads as follows: "Fourteenth—If the said company shall fail to comply with the provisions of this grant for 10 days after notice from the Board of Public Works or Common Council, it shall forfeit all rights hereunder, and this grant may be revoked and annulled by said council." We are not sure that we understand precisely what is the objection to this paragraph. But Mr. Rankine speaks of revoking the grant "for any alleged violation or failure to comply with any of its provisions." We hardly think that the paragraph as it stands is open to any serious criticism, or that it places any arbitrary power in the hands of the city, and we believe that such a provision is quite customary in grants of this character. But it might make the true intent of the paragraph somewhat plainer, and we think would remove all possible objections to it if it were made to read as follows: "If the said company shall wilfully violate or fail to comply with any of the provisions of this grant," etc.

## PERSONAL.

Franklin Overbagh, the manager of the Chicago General Fixture company, is away on a two weeks' business trip in the East. Mr. Overbagh's friends are awaiting his return with perfect assurance that he will have demonstrated that New York and Boston can give no points to Chicago on fixtures.

James R. McKee of the General Electric company of Schenectady has leased the W. H. McCall cottage, No. 8 Circular street, Saratoga, which he will occupy with his family during the winter. Possession will be taken immediately. Ex-President Harrison will spend some portion of the time this fall with the family.

Assistant Secretary C. R. Remington, Jr., of the American Electrical Works of Providence, R. I., who acts as general purchasing agent for this company, is one of the largest buyers of copper in the country, and he has been extremely busy of late in keeping pace with the varied condition of the copper market. In the recent article in the WESTERN ELECTRICIAN regarding the twenty-fifth anniversary of the American Electrical Works, it should have been stated that Mr. Remington connected himself with the American Electrical Works in April, 1882, in the shipping department, being advanced until he was given his present important position.

Henry H. Bentley, president of the Philadelphia Local Telegraph company, died on September 7th at Stamford Heights, near Rhinebeck, N. Y., in his 64th year. Mr. Bentley was identified with the introduction of printing telegraph machines before the war. He went to the front in 1861 as a correspondent, and his letters were voluminous. Just before the close of the war Mr. Bentley again directed his energies to the local telegraph industry, of which he was the pioneer. He built a number of private lines, and these were subsequently merged in the Philadelphia Local Telegraph company, which was capitalized at $400,000, Mr. Bentley being its president. He was president of the Gold & Stock Reporting Telegraph company. When the Bell Telephone company of Philadelphia was organized Mr. Bentley was made its first president, a position which he held for eight years. Mr. Bentley was identified with all the electrical companies controlled by the Western Union management. He was one of the first men to recognize the ability of Thomas A. Edison as an inventor. His home in Philadelphia was on East Walnut Lane, Germantown, where he lived with his wife and son.

## TRADE NEWS.

The Shawmut Fuse Wire company has removed its office and factory from 161 High street to 93 Federal street, Boston. This company is headquarters for fuse wire, fuse links, fuse ribbon, fuse terminals, cut-outs, station switches, fuse blocks, switchboards, fan motors, etc.

The Electric Storage Battery company has closed a contract for a battery to be used in the Edison station at Lawrence, Mass. The battery consisst of 140 cells and will be discharged at 100 amperes for about three hours to assist the generating plant during the period of heavy load.

General Manager F. S. Marr of the Helios Electric company of Philadelphia has returned from an extended trip through the West and reports a marked improvement in the electrical trade since his previous visit. He booked a large number of orders for future delivery.

The Buckeye Electric company of Cleveland is sending out a very handsome catalogue illustrating and describing the very latest forms of incandescent lamps that have been placed on the market by that concern. It is a very creditable publication, a fitting exponent of the superiority of the product of the Buckeye company. It will no doubt be highly valued by the trade.

The incorporation of the Correspondence School of Technology of Cleveland was completed on September 14th. E. P. Roberts was elected president, Thomas Robinson treasurer, and J. C. Gallup secretary. Instruction is given in electrical engineering, steam engineering, bridges, roofs and iron structures, surveying and roads, mechanical engineering and hydraulic engineering.

Stanley Green, of the Fuel Economizer company of Matteawan, N. Y., has sold a 500 horse power economizer to the Fox River Paper company of Appleton, Wis. These mills are rapidly changing from water to steam power and want the best appliances needed for boiler service. Mr. Green has an excellent device and knows how to talk about it, so he readily secured the order.

General Manager A. H. Chadbourne of the M. & B. Telephone company, of Philadelphia, states that the progress of this company has been so rapid that it has been working its factory to the entire limit in order to fill contracts. Some important installations have recently been made in the western and central states and also on the Pacific coast, where an order for a large installation was taken last week.

J. F. Gerleman, the well known traveling salesman for the American incandescent lamp, manufactured by the American Electrical Manufacturing company, St. Louis, was in Chicago last week. Mr. Gerleman has met with well-earned success in the sale of his lamp, which is daily becoming more favorably known among central stations and users in general. The prospect for a large fall trade, in Mr. Gerleman's opinion, is unusually bright.

F. J. Cram, whose reputation as a hustling, successful salesman extends throughout the Northwest, is at present representing the Electric Appliance company of Chicago. He reports a fine trade in Montana, and the outlook in that section is much brighter than it was several months ago. Mr. Cram is very popular with the trade and as the representative of the Appliance company he should do a much larger business than heretofore.

The new Warren alternator is meeting immediate success. J. E. Owen of Onarga, Ill., writes: "I wish to say that we are more than pleased with our Warren improved dynamo. It more than meets our expectations. We have no trouble whatever with it. We run it at 900 to 1,000 revolutions, and do not have to use a transformer on our line. Tell Mr. Warren for me that he did not overestimate the good points of the machine in the least."

The Standard Paint company of New York has been reaching out for a line of foreign trade during the past two years, and the results shown, it reports, are beyond expectation. New agencies will be established in the principal cities of Europe, so to cover thoroughly that important field. General Sales Agent F. S. DeRonde is about completing his 10 years service with this company, having entered their employment in a minor capacity, and being advanced to the position he now holds from the merited appreciation of his ability. Mr. DeRonde's success has been deservedly attained.

The Peru Electric Manufacturing company of Peru, Ind., is a concern that is making itself felt in the electrical field. Among other specialties, it calls particular attention to its Leclede carbon batteries, superior in quality and moderate in price. The Leclede battery consists of a large cylinder of carbon, made oval or round, with opening in the top through which the zinc hangs supported by a porcelain insulator and rubber washer. The carbon forms a perfect lid for the battery and prevents evaporation or the climbing of salts. The Hercules battery consists of a fluted carbon cylinder or vase filled with a depolarizing compound. The large surface of zinc exposed makes it one of the best batteries for open circuit work. The cell is charged with six ounces of sal ammoniac and 28 ounces water, and has an electromotive force of 1.47 volts; internal resistance .11 ohm, and current on short-circuit about 13.4 amperes.

The satisfactory character of the Peck boilers now in use by the Public Lighting Commission of Detroit has called the attention of engineers and large steam users to this improved style of shell boiler. The Detroit boilers are seven in number, each rated at 300 horse power and designed for carrying 165 pounds of steam at working pressure, for serving triple expansion vertical engines. Since these boilers commenced to be operated on the 1st of April the designer, Cassius C. Peck, 39 State street, Rochester, N. Y., has been awarded several contracts of the best class, among which are three 300 horse power externally fired Peck boilers for carrying 150 pounds working pressure for the Ohio Institution for Feeble Minded Youth, at Columbus, O.; one 250 horse power internally fired Peck boiler for 150 pounds pressure for the Bausch & Lomb Optical company of Rochester, and four 300 horse powers externally fired Peck boilers for carrying 165 pounds working pressure to supply 30,000,000 gallon triple expansion pumping engines for the city of Buffalo, it being intended that these engines shall be the most powerful pumping engines yet constructed in this country, and the plant as a whole the most economical in operation of any so far erected.

It is gratifying to note every evidence of the increasing foreign trade of American manufacturers. In many lines, such as railway supplies, the products of American concerns are unapproached for variety, excellence and adaptability by anything made abroad. It would seem as though a wide dissemination of this fact would bring orders from foreign railway companies to the American manufacturers, even allowing for the difference in practice in the United States and Europe. This, at any rate, is the theory acted upon by the Sheffield Car company of Three Rivers, Mich., which manufactures light cars for all purposes and is the sole owner of the patents on three-wheeled cars. Pursuance of this policy has been attended by very gratifying results. Valuable foreign connections have already been established, and this class of business is steadily increasing. It has made necessary the issuance of a special foreign catalogue, in which some of the company's leading appliances are described in English, French, German and Spanish, with accompanying illustrations. Velocipede cars, hand-cars, steel car wheels, push cars, railroad standpipes and tunnel velocipedes are described, but the catalogue does not by any means show all the styles of cars the company manufactures. The large sales made by the Sheffield company in the United States are evidence of the success it has made by studying the needs of railway men in this particular. The new catalogue will be sent on application to all persons in foreign countries interested in light cars of any description.

## BUSINESS.

The trolley wire, poles and rails of the plant of the Fond du Lac Electric Railway company have been purchased by the Swarts Metal Refining company of Chicago.

The Pumpelly-Sorley Storage Battery company has sold, the Sunbeam Incandescent Lamp company thirty 150 ampere hour cells for use in the latter's factory in Chicago.

The Gibbs Electric company of Milwaukee is doing a very successful business, and is putting out about 50 motors a month. The products of this company meet the entire approval of customers.

The Ithaca Desk company of Ithaca, N. Y., claims to have the lowest priced high-grade roll-top desk on the market. The desks are made in quartered oak and mahogany, with plain or raised panels.

Large & Twining of Philadelphia, manufacturers of jack-knife switches of various designs, are about completing a number of important electrical specialties which they hope soon to offer the trade. They report a decided increase in their business and good outlook for the future.

The Electric Appliance company, Chicago, is preparing in pamphlet form for general distribution Prof. Thomas' exhaustive test on the Packard lamp. This test contains information of special value to all lamp users, and can be studied with profit.

J. W. Marsh, general manager of the Standard Underground Cable company, Pittsburg, was in Chicago last week, looking after the company's rapidly increasing business. The Standard company has met with phenomenal success of late, particularly in the West, where the Chicago manager, Mr. Wiley, has done much good work for his company.

All who are interested in the new Freeman battery cell and hard rubber compound will receive prompt answers to their inquiries by addressing J. Frank Dunbar, treasurer of the Newton Rubber Works, 87 Summer street, Boston, Mass. Mr. Freeman will be appreciative if any who have been neglected in the past by failure to receive replies from the Newton Rubber Works will direct their letters to the address given.

Electric soldering, capping and sad-irons, with other heating devices, are made by the American Electrical Heater company of 11 Woodward avenue, Detroit, Mich. Testimonials show the esteem in which the devices are held. The soldering iron manufactured by this company under the Tinnerholm patents has been in practical service in the works of the General Electric company, Schenectady, N. Y., for nearly two years, and has therefore demonstrated its practical success.

Elmer G. Willyoung & Co. of Philadelphia have recently issued a new catalogue entitled "Thinking, Feeling and Doing," which is replete with information regarding some of the best instruments for scientific work which have been offered for sale. Professor H. A. Rowland of Johns Hopkins University has recently perfected a new galvanometer which will be manufactured by this firm and is now ready for delivery. It is said to be one of the most complete instruments of its kind ever manufactured.

E. E. Keller, of the Westinghouse Machine company, has just returned from Europe, where he succeeded in obtaining for his company all American rights in a very important foreign invention. This is the Parsons steam turbine. The steam is transmitted direct from the boiler against the turbine, striking it with great force. The turbine rotates and furnishes the power desired. It is claimed for this kind of turbine that each 15 pounds of water in the boiler will generate one electric horse power.

Writing to the Ohio Storage Battery company of 52 Wade building, Cleveland, ordering 100 Ford-Washburn storage cells, Prof. Daniel W. Shea of the University of Illinois, says: "My experience with them thus far, and the favorable comparison of these cells with the other types which we have already in use, show them to be the most satisfactory thing for general purposes that there is now on the market. I sincerely hope you may meet with the success in your business that you deserve, if the cells which you are now manufacturing are as good a quality as the five which I have had in constant and hard use during the last three years."

The Julius Andrae & Sons company of Milwaukee has just completed wiring 16 floors of the extensive Malt & Grain

company of Milwaukee, also residences of Robert Johnston and Aug. Luedke. The company is installing at present an electric light plant of 275 lights in the Canal street yard for B. Uhrig & Son, and 110 lights for the same firm in the Cherry street yard. Another 110 light plant is being installed for the National Blower company; also wiring the Milwaukee Athletic society's rooms for 100 incandescent lights and the large new show windows of Gimbel Bros. for an equal amount. In the Northwestern Furniture company's new factory the company is installing 150 incandescent lights, also a watchman's time regulator in the same factory and another one in the Espenheim dry goods store. It has sold a three horse power motor to the Milwaukee Exposition company and one to L. Loewe. Besides this it is doing many smaller jobs in the electric line and has just completed the building of a six-mile telephone line, connecting Kekoskee, Le Roy and Mayville and sold another switchboard and telephones for the new exchange at Norway, Mich.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued September 10, 1895.*

545,870. Electric Railway Switch. Rollin A. Baldwin, South Norwalk, Conn. Application filed January 4, 1895.

This invention includes a railway switch point, two electro-magnets adapted to move the same in opposite directions, a circuit changer acting to change the path of the current from one magnet to the other, and an armature common to both magnets and controlling the circuit changer to hold it in a given position until the flow of current ceases, and then to permit it to operate.

545,901. Tubular Pole for Telegraph or Other Purposes. Reinhard Mannesmann, New York, N. Y. Application filed February 9, 1895.

A seamless tube of steel or other metal, having its shell formed integral with sections which successively decrease in diameter and thickness of tube-shell from the base to the opposite end thereof.

545,903. Electric Signaling Apparatus. George E. Miller, Boston, Mass. Application filed August 1, 1894.

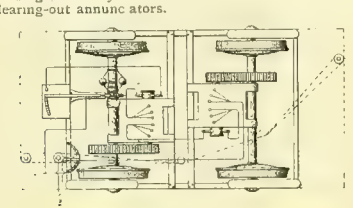
The main line has a continuous insulated sectional conductor extending along the track and electrically continuous track rails. There is also a siding together with an insulated rail in the siding, a generator having one terminal constantly connected to the conductor and the other to the rail, and electrical connections attached to the rail, whereby the circuit will not be closed through the rail until a car rests upon it.

545,904. Electric Signaling. George E. Miller, Stoneham, Mass. Application filed September 6, 1894.

There are a sectional conductor extending along the track, an alternating current generator in the circuit of the conductor, a train, signaling apparatus in the main circuit located on the train and operated by alternating currents, a second circuit on the train, and means in the second circuit for automatically indicating the condition of the main circuit.

545,921. Telephone Exchange Apparatus. Alfred Stromberg, Androv Carlson and Herbert L. Knight, Chicago, Ill. Application filed February 28, 1895.

The combination is described with two telephone lines connected together for conversation, of an individual annunciator in connection with each of the lines, each of the annunciators being provided with a winding included in a bridge or shunt between the two sides of the telephone circuit, each of the annunciators being also provided with a winding included in series with the telephone circuit, the series windings being included in circuit between the two bridges containing the shunt windings, whereby the individual annunciators may serve as clearing-out annunciators.



NO. 546,062.

545,922. Telephone Apparatus. Alfred Stromberg and Androv Carlson, Chicago, Ill. Application filed March 29, 1895.

A stationary block of carbon, a diaphragm supported in front of the same and secured by its edges, a ring of plush or other yielding substance mounted between the diaphragm and the stationary block of carbon, and offering no substantial resistance to the movement of the diaphragm, a space being thus left between the surface of the carbon block and the diaphragm, granular carbon interposed between the diaphragm and the carbon block, whereby the ring of plush holds the granular carbon in position without affecting the vibration of the diaphragm.

545,923. Ship Cleaning Apparatus. Eddy T. Thomas, New York, N. Y. Application filed January 3, 1895.

A supporting frame is provided with a drum to support the motor cable, and the motor operating a cleaning device, in combination with the drum for supporting the conducting wires and the trolley wires.

545,938. Telegraph Receiver. Orlando P. Briggs and William R. Patterson, Chicago, Ill. Application filed October 11, 1893.

A single motor mechanism operates a punch, a movable die is adapted to be brought in engagement with the punch by this mechanism, and means are provided for feeding paper tape between the die and the punch, and for bringing the die and the punch in engagement when a signal is transmitted, whereby a record is made in the paper tape.

545,976. Manufacture of Electric or Other Conduits. Ernest L. Ransome, Chicago, Ill. Application filed November 23, 1894.

In a continuous-subway molding machine a group of rotating cores, the common rear end of which slopes downward.

546,002. Electric Drill. Charles S. Bradley, Avon, N. Y. Application filed August 20, 1892.

A differential phase alternating current generator is adapted to periodically reverse the order of phase delivery; and a reciprocatory motor comprises a series of coils grouped to develop a series of consequent poles, and connected with the differential circuits supplied by the generator, whereby a progression of the poles to and fro along the axis of the coils is maintained.

546,027. Telephone. Edgar C. Parker, London, Eng. Application filed February 14, 1895.

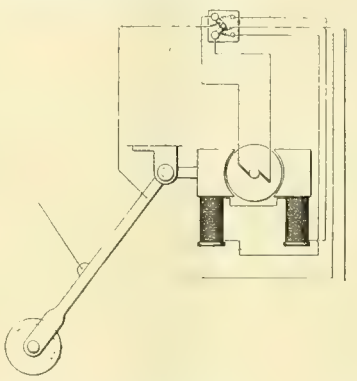
In a transmitter there is claimed the combination with the vibrating diaphragm of a rotatable carbon holder carried in bearings thereon, and carbon in the holder.

546,036. Signal Box. Nathan H. Suren, New York, N. Y. Application filed August 22, 1893.

A cut out switch is composed of two mechanically co-acting movable parts, in combination with means for moving one of such parts by the stopping of the wheel movement of the box, and means for moving the other by the closing of the box door, whereby the switch is controlled by the combined action of the wheel movement and the door.

546,037. Signal Box. Nathan H. Suren, New York, N. Y. Application filed January 25, 1894.

The combination of a signal box is claimed, of a switch having local circuit, short circuit and test-circuit contacts, and switch arms for making contact with the contacts, arms being moved onto the local circuit contacts upon the opening of the door, onto the test circuit contacts by hand, and onto the short circuit contacts upon the closing of the door, substantially as set forth.



NO. 546,130.

546,059. Electric Railway. William M. Schlesinger, Philadelphia, Pa. Application filed November 24, 1885.

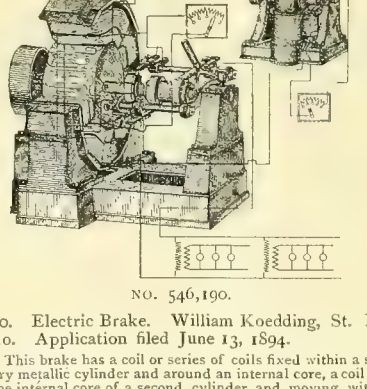
A working conductor is composed of insulated or disconnected sections normally closed multiple arc relation, with a feeding conductor by way of magnets, right angle levers and contact points, and one of the levers carrying or having affixed thereto an armature for the magnets, which act by excess of current passing through them to cut the sections out of the feeding conductor.

546,062. Speed Regulator for Electric Cars. Isaac D. Aikin, New York, N. Y. Application filed May 4, 1895.

The cut shows a speed regulator for electric cars, having, in combination with the propelling motors, main rheostat and hand-operating devices, an independent box of resistance coils supporting pivotally the piece provided with the insulated arm forming a part of the motor circuit, and adapted to be brought into contact with each of the coils, the pivoted piece possessing a second arm slotted near its outer end to engage the pin projecting from the sleeve, which is movable upon the axle of the car and the centrifugal governor.

546,090. Cut-off Actuating Mechanism for Gas or Electric Light Systems. Frederick W. Cotton, Dedham, Mass. Application filed November 12, 1894.

One claim is for a main gas valve, a water motor to close it, a supply pipe for the motor, having a normally open shut-off and an electric switch combined with a spring-controlled normally locked actuating lever connected to the shut-off and electric switch, and means to unlock the lever by the closure of the gas valve, whereby the lever is rapidly swung to instantly throw the switch and close the shut-off.



NO. 546,190.

546,120. Electric Brake. William Koedding, St. Louis, Mo. Application filed June 13, 1894.

This brake has a coil or series of coils fixed within a stationary metallic cylinder and around an internal core, a coil around the internal core of a second cylinder and moving within the first cylinder, the core-facing end of the stationary coil being preferably cone shaped, and the corresponding core-facing end of the movable coil funnel shaped.

546,130. Closed Conduit Electric Railway. John M. Deal, Fernwood, Pa. Application filed November 26, 1894.

The combination includes a car and an electric motor thereon, a magnetic trolley arm directly connected with the pole piece of the motor, and electrical connections between the arm and the motor.

546,143. Electric Railway System. Henry A. Fry, Portland, Ore. Application filed June 13, 1894.

A slot rail is employed, having a pendant vertical flange extending down into the conduit, a conductor located beside the flange, and a trolley having a wheel running against the conductor, and provided with an insulated wearing face adapted to abrade against the flange.

546,190. Regulator for Alternating Current Dynamos. Edwin W. Rice, Jr., Lynn, Mass. Application filed March 16, 1888.

The first claim is for the combination in an alternating current dynamo of two field sustaining coils, one supplied from an armature coil connected directly therewith through a commutator, and other the forming a path for the main alternating currents passing to the work from an independent armature coil or coils, a commutator placed in the main circuit for locally commuting currents to the latter coil, a branch from the commutator terminals which are connected to the coil, and an artificial resistance in the branch.

546,191. Electric Locomotive. Edwin W. Rice, Jr., Schenectady, N. Y. Application filed March 16, 1895.

A self-contained electric locomotive, a prime mover, direct current generator and separately excited rotary transformer, with alternating motors mounted on or geared to the axles of the locomotive, and means for varying the periodicity of the current supplied to the motors from the rotary transformer.

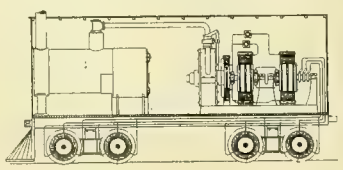
546,220. Art of Manufacturing Electro-magnets. Harold P. Brown, New York, N. Y. Application filed January 26, 1893.

In the manufacture of electro-magnet coils, composed of metal tape and insulating tape coated or impregnated with liquid shellac, the process consists in first gradually heating the coil by application of current thereto to a sufficient degree to slowly evaporate the alcohol and moisture from the shellac, and then heating the coil by increase of current to a high temperature to solidify and carbonize the shellac to a greater or less extent, and cement the coils together in one rigid solid mass.

546,228. Signal Transmitter. Willie H. Davis and Hugh C. Christy, Como, Colo. Application filed June 3, 1895.

A cam, an angle lever actuated thereby, a toe on the cam, an angle lever connected to the first angle lever and actuated by the toe, a revolving drum a contact arm connected to the angle levers, and electrical connections.

546,232. Insulator, Conductor and Conduit for Electrical Wires and Cables. Wilber R. Hitchcock, Cornwall, Can. Application filed October 12, 1894.



NO. 546,191.

In combination with an electrical railway conduit containing wires and cables an arm is connected with a car, and carries a trolley inside the conduit, a slotted body attached to the car, through which the arm slides vertically, a cap piece covering a gap in the side of the body, and a spring for holding in place the cap piece.

546,233. Automatic Electrical Cut-out. Charles C. Kritzer, Grand Rapids, Mich. Application filed October 31, 1894.

A fixed contact, having a circuit connection therewith, a suitably arranged stationary pivot post having a circuit connection therewith, an automatically released circularly swinging switch bar pivotally mounted on the post and having a contact to engage the fixed contact, and a circular insulator wall encircling the stationary post and interposed between the fixed contact and the stationary pivot post to obviate a short-circuiting of the current between these parts when the contacts are broken.

546,238. Electric Igniter for Gas Engines. Frank S. Mead, Montreal, Can. Application filed February 26, 1895.

An electric igniter for gas engines is described, comprising a fixed electrode and a movable electrode mounted eccentrically on an oscillating or revoluble shaft or journal.

546,247. Electric Brake. William B. Potter, Schenectady, N. Y. Application filed January 19, 1895.

Included in this mechanism are a controlling switch for the electric motors, a brake switch, a reversing switch, and means adapted to prevent a simultaneous operation of any two of the switches

546,261. Automatic Electric Fire Alarm. Charles D. Tisdale, Boston, Mass. Application filed February 12, 1895.

The first claim follows: In an electric fire alarm device, a tube extended along and around the side or sides of a room or other place, an upward extension of said tube, a wire connected with one pole of an electric battery arranged in said tube extension insulated therefrom, a chamber at the other end of said first tube, a plunger or piston therein, and operated from the outside, and mercury in said tubes and chamber, and connected electrically with the other pole of the electric battery.

546,262. Automatic Electric Fire Alarm. Charles D. Tisdale, Boston, Mass. Application filed March 25, 1895.

In an electric fire alarm there is claimed the combination with an electric motor, electric battery and electric magnet, of a continuous wire of uniformly fusible material connected at one end to the magnet, a wire connecting one end of the fusible wire to one pole of the battery, a wire connecting the magnet with the other pole of the battery, a wire from the battery to the motor, a sounding device, a wire connecting the sounding device to the motor, a terminal or block, and a wire running from the sounding device to the block.

# Western Electrician.

EVERY SATURDAY.

Vol. XVII. CHICAGO, SEPTEMBER 28, 1895. No. 13

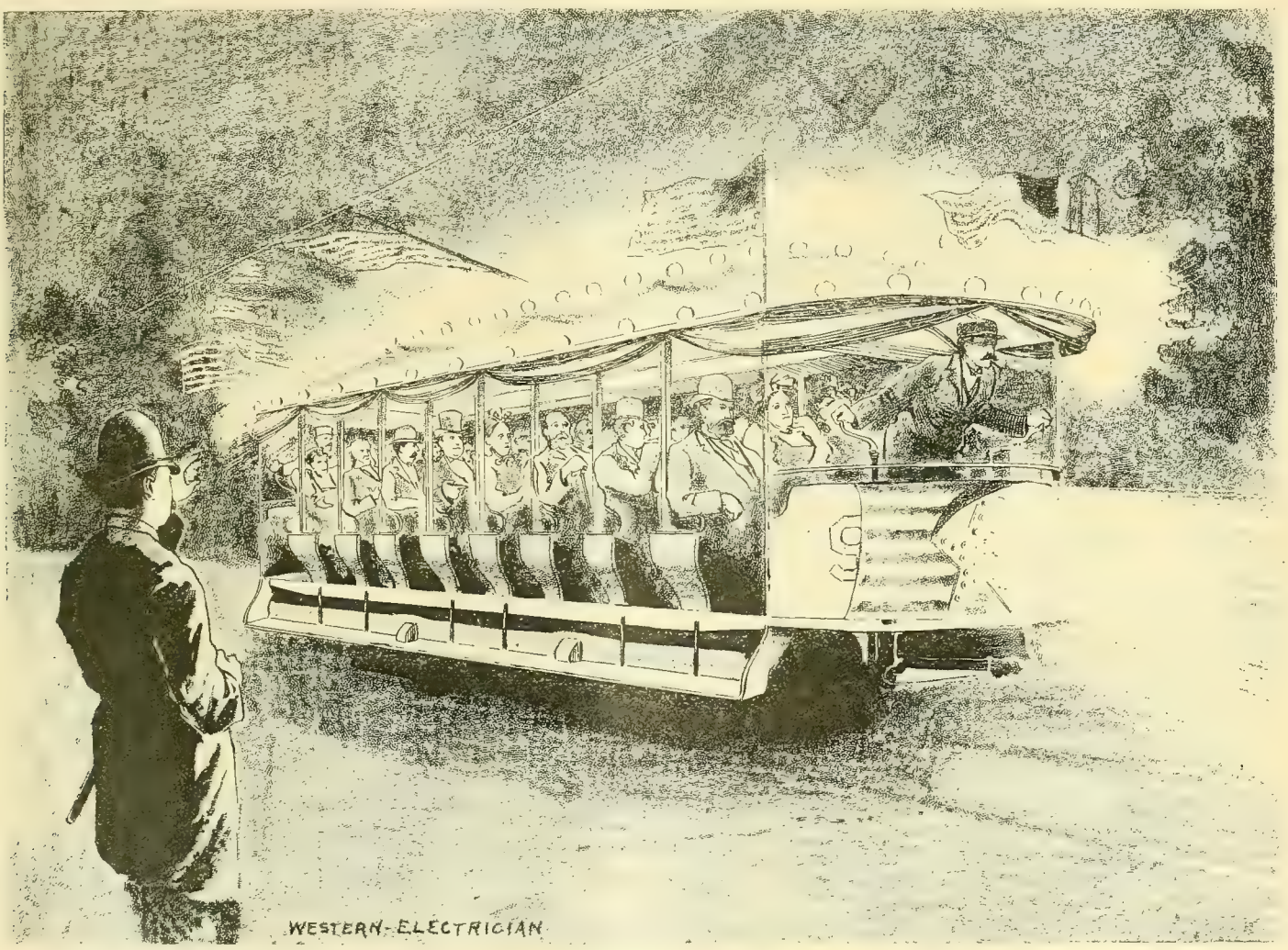

## Trolley Parties Popular in Chicago.

Trolley parties are popular in Chicago. There was a novelty about the idea that at once appealed to the Chicagoan, and the readiness with which the local street railway companies furnished facilities for gratifying the demands of the public in this matter added greatly to the popularity of the scheme. Then, too, Chicago is singularly fortunate in having picturesque roads extending from the city proper into the surrounding country; the trip to Evanston, for instance, being one of the most attractive offered by any electric road in the country. There is a variety of scene on this line that can be found upon very few pleasure routes in the country. To many the most enjoyable feature of the trolley party is the fact that it is much cooler than the theater and has something of excitement without the element of danger or inconvenience that many summer amusements have. The "fad," for such it has become among fashionable people, has passed through several stages of development and is now conceded to have reached a degree of perfection.

Special cars have been assigned by several companies in and about Chicago for this service, and they are prettily decorated and brilliantly illuminated for these occasions. Several pretentious excursions have been taken by the social night-hawks of Chicago during the last few weeks, and an idea of the spectacle presented can be gained from the accompanying illustration. When it is remembered that these trolley parties are usually bowled along at the rate of 25 miles an hour it is not to be wondered that the natives of the district through which they passed, at first looked upon them with awe and in some cases superstitious alarm.

About three weeks ago this popular fad of trolley-car parties struck the north end of town in earnest and a motor car was fitted up for the occasion. Irving Park, Jefferson Park and Evanston were startled late in the evening by the appearance of a hilarious party of twenty under the guidance of Postmaster Washington Hesing of Chicago. This was the inauguration of the trolley-car party business of the North Shore Electric Railway company, and it has been rushing ever since. John J. Mitchell with about 20, Howard Abel with 50, the Jefferson Park club with a brass band and about 75, are some of those who followed suit. The ride consists of an entire circuit of the company's lines, making a trip of 60 miles in all and occupying about three hours' time. Starting at the limits barn at Diversey avenue and Clark street, the route usually taken is over Belmont avenue to Irving Park, back to Belmont avenue and to Milwaukee avenue and on out to Jefferson Park, returning then to the limits barns and going direct to Evanston and return, making a most enjoyable ride. Several stops can be made.

Superintendent R. S. Ives said that he had his "slate full of dates" up to November 1st and applications were still coming in. He has two motor cars fitted up for this work, both decorated alike in bunting and flags and incandescent lamps, the latter literally covering the cars, there being 125 lamps to a car. Trailers are often carried, and these are trimmed and decorated to correspond. Assistant Superintendent H. W. Emrick, who has taken quite an interest in this branch of the work, thinks that it can be developed into a considerable attraction.




TROLLEY PARTIES POPULAR IN CHICAGO.

## Proposed Overhead Trolley System for Chicago's Business District.

The Chicago City Railway company has renewed its efforts to secure the right to operate its electric cars on Clark street as far north as Washington street. An amended ordinance granting this privilege to the corporation was introduced in the Council by Ald. Hepburn and referred to the Committee on Streets and Alleys South, of which he is chairman. An ordinance of this character was passed last July, but it met the disapproval of the mayor. As the mayor could not defeat the ordinance the company having agreed to contribute $25,000 for street lighting purposes and $30,000 toward the construction of a viaduct at Clark and Sixteenth streets, he consented to allow cars to come to the south line of Jackson street, although if he had had his own way he would have kept them down at Van Buren street. The council compromised the question at issue between the mayor and corporation by making Adams street the northern limit of the trolley line. The company accepted this ordinance, but the property-owners on Clark street and intersecting streets north of Adams at once started a movement to have the line extended as originally intended to Washington street. It is stated now that a large majority of the property-owners on Clark, between Adams and Washington, have signed a petition for the road, and the general opinion is that the ordinance in compliance with their request will be passed, even though the mayor should continue his opposition to it. Property-owners and merchants on Clark street favor the scheme. One of these said:

I am in favor of the ordinance and if passed it will no

doubt benefit the district between Adams and Washington streets to a great extent. It will bring a great many new purchasers to Clark street from the southwestern portion of the city and will open and make accessible the upper part of Clark street to people living along Archer avenue in the Stock-yards and Englewood, and all west of Englewood. It will certainly increase business and rents along the entire line of Clark street. All the tenants along Clark street, from Adams to Washington street, are very anxious to have the line extended. And also the tenants occupying cross streets, such as Madison and Monroe, are signing petitions to that effect. We are putting forth our best efforts toward getting the signatures of the property-owners and have succeeded to a very encouraging extent.

Mayor Swift was in New York at the time the ordinance came up and he gave the following statement to a correspondent:

It is true that I made the statement that I would veto such an ordinance, and I see no reason to change my opinion as expressed at the time the original ordinance was passed by which the trolley line was permitted to be built as far north as Adams street. I am still most emphatically opposed to the introduction of the trolley system into the center of the business district of the city. I propose making a thorough investigation of the underground electric system on Lenox avenue. I am assured that this system is a perfect success, and if, upon investigation I am satisfied this is the case, I shall insist upon its adoption in Chicago.

## Armor Plates Annealed by Electricity.

An important application of electricity, the annealing of armor plates is thus discussed by W. W. Hanscom, chief electrician of the Union Iron Works of San Francisco, in an interesting article in the *Pacific Electrician:* The nickel steel armor plates, as furnished the later vessels of the United States navy, are by the Harvey process hardened on the face to a depth varying from one-half inch to three-fourths inch. This face is such that it successfully resists the hardest steel drill that can be made, and as it is required in the final location of the plate to drill and tap numerous holes in it, it was necessary during the hardening process to protect the desired places by preventing the carbonizing material from coming in contact with them.

The operation was not entirely successful, however, as it was found upon trial that although a number of the plates were sufficiently soft to be worked, others immediately alongside were as hard as the unprotected portions. A number of attempts were made to locally anneal these hard spots by means of the oxyhydrogen blow-pipe and other apparatus, the most successful being that offered by the Thomson Electric Welding company of Lynn, Mass. It was found impossible by other means than electricity to apply sufficient heat in a concentrated form to attain the desired results, as the large mass of metal surrounding conveyed the heat away as fast as it was supplied.

One of the electric welding company's annealing equipments has recently been installed at the Union Iron Works for annealing the armor plates of the battle ship Oregon, and the following is a description of the plant and its operation: The apparatus in general consists of an alternator, with its exciter, a regulating rheostat, a transformer annealer and the engine for driving the same. The engine develops, at 450 revolutions per minute, 55 horse power. The alternator and exciter are of the well known commercial type; the former, of 40 kilowatts capacity, has six coils on as many pole pieces, the windings being in two series of three in multiple. The armature is of the toothed type, with six coils, connected in a multiple of three series of two. It is wound for an output of 135 amperes at 300 volts, when making 1,000 revolutions per minute. A pulley on the end of the armature shaft drives the exciter, a D type shunt wound generator of 110 volts, at 2,000 revolutions per minute. Its terminals are connected to alternator fields through the regulating rheostat, a cylindrical frame, having German silver coils cut into or out of circuit by a contact arm on top. The coils are protected from mechanical injury by the wire gauze covering, which arrangement permits of a constant circulation of air. The transformer annealer, as shown in Fig. 1, is of the shell type, and consists of an outer core of laminated iron surrounding both primary and secondary coils, the former being wound on a form and incased inside the latter, which is a hollow copper casting made in halves to receive it, and then bolted together, after which the remaining space is filled with oil for insulation and as an assistance in conducting away the heat generated in the primary. The secondary coil has but a single turn, U-shaped, to the ends of which are bolted various shaped copper contact pieces which are hollowed and connected to a water circulation, thus preventing the heat of annealing from reaching the coils. The yoke from which the transformer is suspended by two trunnions, as well as the beforementioned contact pieces, permit of the transformer being swung into any desired angle and brought against any part of plates already located.

In the operation of annealing the contact pieces are brought up against the brightened surface of the plate and wedged into position, straddling the spot to be annealed, after the regular rheostat has been adjusted to a point reducing the primary current to a minimum. The distance between the contact pieces for a hole seven-eighths of an inch in diameter is 1¾ inches. When the contact is established between contact pieces and the plate a slight humming noise notifies the operator, and the primary current is gradually raised to its maximum. A bright red spot then appears under each contact piece. The intense local heat at these spots causes the plate to expand outwardly in the direction of least resistance, forming slight mounds, from which circles of a gradually changing color slowly ap-

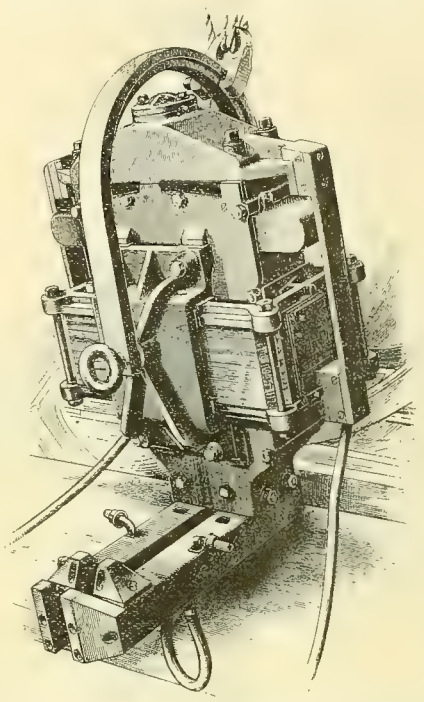


FIG. 2. ARMOR PLATES ANNEALED BY ELECTRICITY.

proach the center. The primary is kept up till the plate has become sufficiently heated to char or even ignite a pine stick held against it, and is then gradually decreased until it has again reached the minimum.

The first or heating period requires about three minutes, during which the secondary current has reached from 3,500 to 6,000 amperes at four volts. The second or cooling period requires from 10 to 12 minutes, in order to prevent the sudden chilling of the spot due to the surrounding mass of metal and to insure a perfect anneal. The plate at the spot of annealing presents a dark blue color, elliptical in shape, with a major axis of four inches and a minor axis of 2½ inches, and is very readily drilled and tapped.

Fig. 2 shows the annealer at work on a 17 inch plate for the Oregon's 13 inch barbette. A portable drill press driven by a direct current motor is shown in the background, ready to drill the holes as fast as the plate is annealed. The regulating rheostat is shown in the lower right-hand corner. Four wires are led from alternator and exciter to a convenient spot and connected to annealer and regulating rheostat through a flexible four-wire cable.

It is said that the Grand Trunk railway officials are figuring on a system of electric locomotives for use in the tunnel under the Detroit river at Port Huron, similar to the Baltimore tunnel equipment

## Equipment of the Home Telephone Company, Chillicothe, Ohio.

An interesting example of the progress that is being made by independent telephone companies in establishing competing exchanges in cities already provided with Bell service is presented in the case of Chillicothe, Ohio, where the Western Telephone Construction company of Chicago has established an exchange controlled by local capitalists. The Home Telephone company was formed on February 16th, and the merchants of the town and prominent residents pledged their support to the enterprise. According to a local paper "the success that the company met with, in securing contracts, seemed incredible, and must be, in part, attributed to the feeling, on the part of the people, that they had been oppressed, and arbitrarily treated by the old company, backed as it was by the Bell monopoly." The same paper is authority for the statement that before the exchange was opened the new company had secured five-year contracts from 300 subscribers. The franchises with the city were speedily secured; the franchises with the county followed, and the negotiations for taking in, through contract, the private lines throughout the county, were speedily entered upon and with every promise of success. In entering the field, the Home company made no promises to give any outside connections, but it now declares that it intends to give connection with about all the villages in the county. Local subscribers are already connected with Frankfort, Roxabel, Clarksburg, Andersonville, Anderson Station, Sulphur Lick Springs, Londonderry, Vigo and Richmondale, and arrangements have also been made for a line to Kingston, Adelphi, Hallsville and Kinnikinnick, and plans are on foot for reaching other points, so that practically, the whole of Ross county will be in telephonic communication soon.

Local subscribers speak highly of the service given by this exchange and the people are all well pleased with the methods and plans of the Western Telephone Construction company, which put in the plant. A view of the operators' room in the exchange is given. A feature of the service is the promptness and attention given to night calls, something heretofore unknown in that section of the country. The Home company announces that it intends to make a feature of the night service, and that the contract with the city for a police patrol system enables it to give as prompt service at night as during the day. The company nite subscribers who may wish to catch an early morning train, or who, for any reason, may wish to be called during the night, to notify the central office before retiring and the telephone bell will be rung at the hour desired. Already the new company has a strong hold upon the people of Chillicothe and vicinity.

## Circuit-testing Patent Litigation.

In the suit of the Western Electric company against the Brush Electric company on patent No. 476,317, issued to the late C. H. Rudd, June 7, 1892, for a system of testing electric circuits, a final decree was entered September 19th, by Judge Showalter of the United States Court finding the patent valid, and infringed by the Brush Electric company.

EQUIPMENT OF THE HOME TELEPHONE COMPANY, CHILLICOTHE, OHIO.—OPERATORS' ROOM.

The patent in question covers a system of locating grounds and other troubles on an electric light circuit which consists in providing an artificial circuit of high resistance at the station and adapted to be connected to a line circuit, the resistance of the artificial circuit being fixed and so apportioned between contact points that the attendant, by means of a testing set, may find the neutral point in the artificial circuit corresponding to the neutral point of the line circuit connected therewith. Claim one of the patent is as follows: "In an electric light system, an artificial circuit containing

high resistance of invariable amount, said artificial circuit being connected with the different sides of a dynamo-machine while supplying current to a working circuit, said artificial circuit having its resistance apportioned between connecting-sockets, in combination with a testing apparatus for determining the neutral point of said artificial circuit, substantially as and for the purpose specified."

## THIRTEENTH CONVENTION

### Of the Street Railway Association of the State of New York.

The thirteenth annual meeting of the Street Railway association of the State of New York was held at the rooms of the Young Men's Christian association, Albany, N. Y., Tuesday, September 17th, at 10:30 A. M. President G. Tracy Rogers called the meeting to order and J. P. E. Clark of Binghamton was elected temporary secretary. There was a large attendance of representatives of street railway companies, and numerous supply men were also present, as will be seen from the official list of members and visitors appended:

MEMBERS.

Allen, C. L., Civil Engineer, Syracuse Street Railway company, Syracuse.
Bissell, Charles J., Counsel, Rochester Railway company, Rochester.
Cahoon, J. B., Superintendent, Elmira & Horseheads Railway company, Elmira.
Cole, W. W., Superintendent, Elmira Street Railway company, Elmira.
Clark, J. P., General Manager, Binghamton Street Railway company, Binghamton
Cleminshaw, Charles, President, Troy City Railway company, Troy.
Cooper, H. S., Superintendent, Schenectady Street Railway company, Schenectady.
Everts, Frank L., Superintendent, Utica & Mohawk Railway company, Utica.
Frick, Benjamin, Secretary and Treasurer, Atlantic Avenue Railroad company, Brooklyn.
Havens, William E., Superintendent, Fishkill Street Railway company, Fishkill.
McKeever, R. T., Superintendent, Johnstown Street Railway company, Johnstown.
McNamara, John W., Treasurer, Albany Railway company, Albany
Meiklehan, T. M. R., Superintendent, B., Q. C. & S. Railway company, Brooklyn
Morgan, Godfrey, Manager, Amsterdam Street Railway comyany, Amsterdam
Norton, Benjamin, President, Newburg Railway company, Newburg.
Newton, H. S., Electrical Engineer, Syracuse Street Railway, Syracuse.
Rogers, G. Tracy, President, Binghamton Street Railway company, Binghamton.
Rusling, F. O., Superintendent, Buffalo Railway company, Buffalo.
Smith, Charles H., Superintendent, Troy City Railway company, Troy.
Stedman, J. H., Transfer Department, Rochester Railway company, Rochester.
Story, C. B., Secretary, Hoosick Falls Street Railway company, Hoosick Falls.
Vickers, Albert, Electrician, Syracuse Consolidated Street Railway company, Syracuse.
Wardwell, John S., President, Rome City Street Railway company, Rome.

VISITORS.

Allison, Giles C., St. Louis Register company, St. Louis.
Barnard, J. H., Interior Telephone company, New York.
Barrett, Charles E., Hale & Kilburn Manufacturing company, Philadelphia.
Brady, Paul T., Westinghouse company, Syracuse.
Cockey, Marston R., John A. Roebling Sons' company, New York.
Delaney, William H., New York.
Dutton, W. S. Doerner & Dutton, Cleveland.
Estep, F. A., Nuttall company, Allegheny.
Evans, H. C., Johnson company, New York.
Everts, D. T., Simplex company, New York.
Ewing, Geo. C., Electrical Specialties, Boston.
Fowler, F. H., Bemis Car Box company, Springfield.
Ham, W. F., Johnson company, New York.
Hanna, J. A., McGuire Manufacturing company, New York.
Issertel, H. G., H. W. Johns Manufacturing company, New York.
Lawless, E. J., American Car company, St. Louis.
Long, E. G., Peckham Motor Truck & Wheel company, New York.
MacDuffie, R. L., Taunton Locomotive Manufacturing company, Taunton.
McElroy, J. F., Consolidated Car Heating company, Albany.
Medbery, H. J., Fiberite company, Mechanicville.
Mercur, R. J., New York Car Wheel company, Buffalo.
Morse, George C., Rochester Car Wheel company, Rochester
Newkirk, H. R., Hoefgen, Moxham & Co. New York.
Ostrom, John F., Pennsylvania Steel company, Philadelphia.
Packer, E., St. Louis Register company, New York.
Pugh, D. W., Stephenson company, New York.
Pugh, John S., Stephenson company, New York.
Robert, Louis E., Johnson company, New York.
Rose, R. M., Hughes Register company, New York.
Russell, F. D., Rochester Car Wheel company, Rochester.
Sharpe, D. W., Newark, N. J.
Silver, William S., Graduated Car Spring company, New York.
Vosburgh, A. C., New Process Raw Hide company, Syracuse.
Wallace, J. E., Smith & Wallace, Boston.
Wardwell, F. S., Electric Railway Construction, Danbury.
Wardwell, V. P., Electric Railway Construction, Danbury.
Washburne, William A., Cambria Iron company, New York.
Wood, Charles N., Nuttall company, Boston.
Yates, F. A., Trendley Brake company, St. Louis.

The first order of business was the annual address of the president. After extending a hearty welcome to the delegates and visitors, President Rogers paid a tribute to the late secretary and treasurer, William J. Richardson, who had been so closely identified with the work of the association. The growing membership was referred to as a matter of congratulation, and the fact that adverse legislation had been headed off was also mentioned. Concerning advances and improvements in street railway construction and management, the report says: "The result of the year's experience shows a demand for better roadbeds and overhead construction, heavier rails, more ties, better ballasting, lighter motors, better machines, and more conservative financiering." Elaborating this idea President Rogers said:

A great deal has been said and written regarding the substitution of electricity for steam for through traffic, and some of these articles have been severely criticised. The fact that electric traction is being considered by steam railroad people makes it a subject of general interest. They may adopt electricity on some of their suburban lines to protect their local travel, which we have taken from them whenever and wherever we have gone after it, but the results cannot materially affect the interests of street railways. We carry our patrons to their door-steps, the public streets are our depots, we have no expensive stations to maintain, our traffic is more certain, less affected by business depressions and more capable of development than that of the steam railroad. These are advantages that the steam railroads are unable to overcome, and together with the paralleling of steam railroads by electric railways have forced a number of railroad companies into purchasing electric lines, and there is evidence of increased activity in that direction.

The adoption of an electric motor in Chicago to propel a cable road; the Westinghouse-Baldwin combine; the 90-ton freight engine on the Baltimore & Ohio road; the building of the electric railway at Nantasket Beach by the New York, New Hampshire & Hudson Railroad company, as a part of its system over which electric cars and locomotives are run intermingled, and the electrical construction of the Mount Holly branch of the Pennsylvania railroad, all point to an endorsement of electricity as a motive power.

An experiment is now in progress in New York with power from conductors in an underground conduit, the results of which will be watched with great interest, as it may be the beginning of a new regime in street railroad work in large cities. The results, however, can have no effect in smaller cities on account of the cost.

We now have in this state about 1,400 miles of track and an investment of upwards of $200,000,000. We carry every year seven times the population of the entire United States and over one third the population of the entire world—over 500,000,000 of passengers annually—while the steam roads carry but 160,000,000. The gross receipts of this street railroad traffic are about $25,000,000.

The best and most reliable financial papers now seek and publish such statistics as are obtainable regarding street railways. The financial world demands this information and we are compelled to furnish the figures, favorable or unfavorable. Street railroad securities, as permanent investments, are in better favor than ever before.

The consolidation for the purpose of controlling all the street railroads in any one city and the rapid extension of cable and electric lines, both urban and suburban, have attracted the attention of financiers and investors, and large sums of money have been invested both by local and foreign capitalists. And here I would suggest the importance and wisdom on the part of any road of placing it securities with the local investor, if possible, for reasons too obvious to mention.

The cost incident upon the change from animal power to cable or electric was staggering to the investor. The large electric companies came to the rescue in many instances, after gathering statistics of operations and increased receipts caused by the adoption of rapid transit and ascertaining the ability to earn more than enough to pay the interest on the cost of the change. Such information unfortunately invited speculating capitalists, who, in many instances, took advantage of the additional profit.

Over-capitalization, which has been prevalent in years past, is gradually disappearing by reason of foreclosure of mortgages and a general desire for conservatism on the part of financial people interested. In a growing city, with a sound franchise, reasonable capitalization, and a well installed system for which too much has not been paid, the securities should and do commend themselves to the conservative investor.

The fields which are rapidly opening and which invite our attention are numerous and I shall call your attention to but a few. The United States government is asking us to carry its mail; society has popularized us with its trolley parties; the express companies are negotiating with us to handle their freight; the merchants wish us to carry their goods; the farmer his milk and farm produce; and we are asked to arrange for funeral trains to the cemeteries. We are to-day closer to the public than ever before. Many, if not all of us, have learned to appreciate the fact that the public is not to be beaten and that we must conform to its wishes. The manager who meets with fairness and justice the demands of the public and who trains his help to be gentlemanly and courteous to all, not only increases the receipts, but makes friends for his road of the riding public, the city officials and the press. I claim that the best fender on the front of our cars is a clear-headed, careful man of good judgment to handle the brake and motor.

The street railway now demands in every department the best ability that can be secured for it. Too much care cannot be exercised in selecting men to manage each department as well as to operate the road. This in my opinion, is the one principle underlying the success of a street railroad as well as of any other business enterprise.

Competition and recent inventions have leveled the price of nearly all electrical apparatus and supplies to a commercial trade basis Many of us can repair and in most cases replace a large percentage of our equipment in our own complete machine shops.

The present demand is for a lighter motor and a flexible suspension of the motor to avoid pounding on the joints. I believe this can be obtained and am pleased to learn that some of the companies are working in this direction. There is still work for the inventor. The extension of our roads into the country and the connection of roads to form a large system brings up the question of potential and feeders. We may look for some valuable experiments in the use of the alternating current on street railway lines. This, in my opinion, is one of the most, if not the most, important and interesting subject that confronts us at the present time.

Many attempts have been made to produce power from compressed air, acids, and numerous other agencies, but as yet none have been able to compete with electricity in

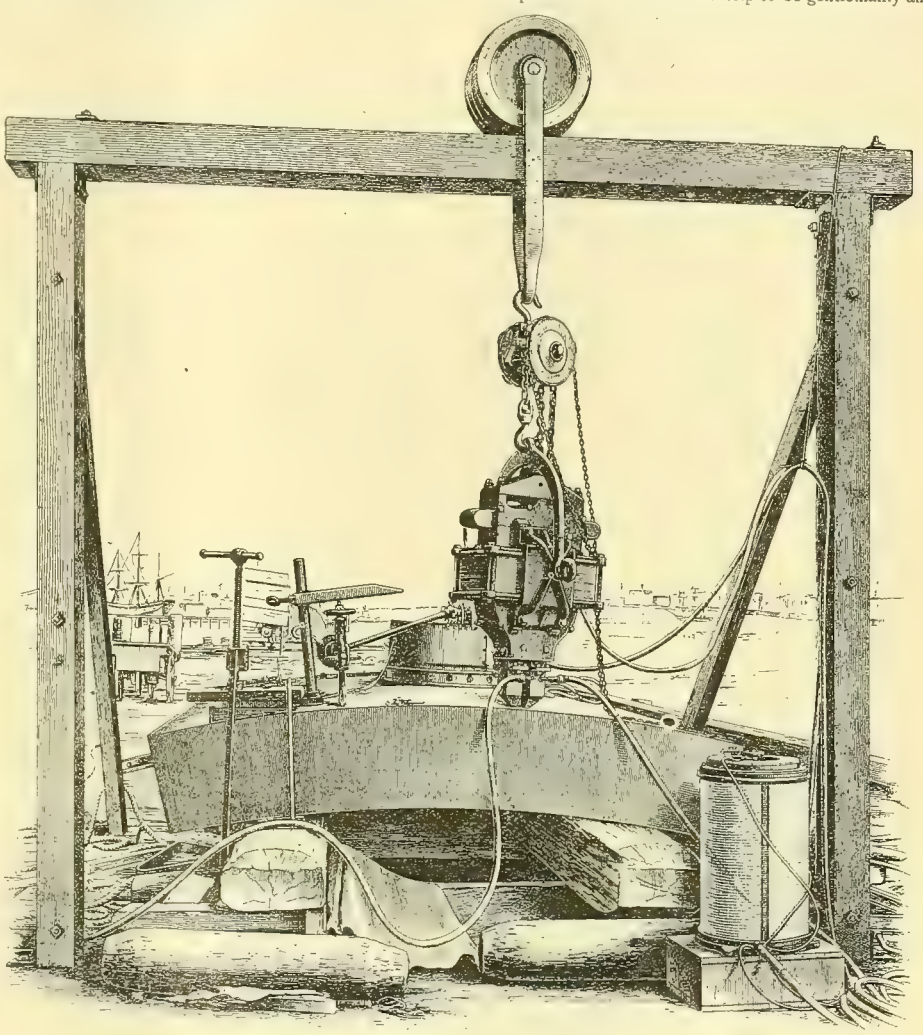


FIG. 1. ARMOR PLATES ANNEALED BY ELECTRICITY.

economy and efficiency. However, we are ready to accept any innovation the ever-busy inventor may produce by which we can reduce the cost of operation.

In the report of the executive committee the announcement is made that as a result of determined effort on the part of the officers the present membership is the largest in the history of the organization, comprising 39 members. The following companies have united with the association since the last annual meeting: Kingston City Railroad company, Olean Street Railway company, Rome City Street Railway company, Newburgh Electric Railway company, Pelham Park Railway company of City Island; Citizens' Street Railway company, Fishkill-on-the-Hudson; Lock City Street Railway company, Lockport; Ogdensburgh Street Railway company, Hoosick Railway company of Hoosick Falls, and Ulster County Electric Railroad company of Kingston. There has been but one withdrawal during the last year, namely, the Union Railway company of New York. The report adds:

The growth and development of the association during the year is most encouraging, and should stimulate renewed effort to induce all of the street railroad companies of this state to become identified with us, thereby placing our organization foremost among the various state street railway associations of the country, a position to which it is justly entitled.

In this connection the committee's recommendation concerning the legislature is interesting:

Upward of 30 bills pending in the senate and assembly of this state at one time, all of which, with very few exceptions, were obnoxious and adverse to the interests of street railroads throughout the state, will enable you to form an idea of the activity during the past year of legislation affecting street railroads and their operation, without questioning the good intent of the various members presenting these measures.

Had half of the bills offered become laws, street railroads would have been driven out of business. Energetic, prompt and persistent effort on the part of this association and its active counsel undoubtedly aided materially in defeating a large number of the adverse bills. The presiding officers of this association, together with the counsel and different members of the association appeared from time to time before the various committees of the assembly and senate, to whom these bills were referred, and in every instance were accorded courteous treatment and a polite hearing, and found only a disposition on the part of the various committees to treat all questions uprightly and fairly.

With the increased number of representatives comprising the next session of the legislature it is consistent to anticipate the presentation of an increased number of bills affecting our interest, therefore your committee urges the importance of the continuance and enlargement of this association, so that united effort and concerted action may be obtained in considering and meeting the various issues as they arise. Increased membership and active interest in our organization will prove fruitful of beneficial results.

Since our last meeting new laws of special importance affecting organization, have been enacted, namely: Chapter 545 of the laws of 1895, amending section 59 of the railroad law, so that street railroad companies hereafter formed must obtain consent of the Railroad Commissioners to build; also amending section 91 of the Railroad Law, by providing that outside of cities and villages two-thirds in consents of abutting property must be obtained; also chapter 933 of the laws of 1895, which allows street railroads to condemn property, except in cities. These are important measures which betoken the activity of the steam railroads, and demonstrate that they recognize the introduction of electric suburban roads as formidable competition.

The growth and development of the street railroad business of this state during the past year is extremely gratifying. Changes to electricity as a motive power are of frequent occurrence. Many new roads and numerous important extensions have been completed and are now under way. The following roads have been granted the privilege to use electricity as a motive power during the past year: Walden & Orange Lake; Herkimer, Mohawk, Ilion & Frankfort, Staten Island Midland; Metropolitan Street (underground current); Lenox Avenue (underground current); Twenty-third Street, New York (cable); Stillwater & Mechanicville; Troy City Railway and lessee of Troy & Cohoes; Union Railway, New York—Southern Boulevard; Rome City Street Railway (compressed air motors); Ogdenburg Street Railway; Buffalo & Niagara Falls; Cohoes City Railway; New York, Elmsford and White Plains; Balston Electric.

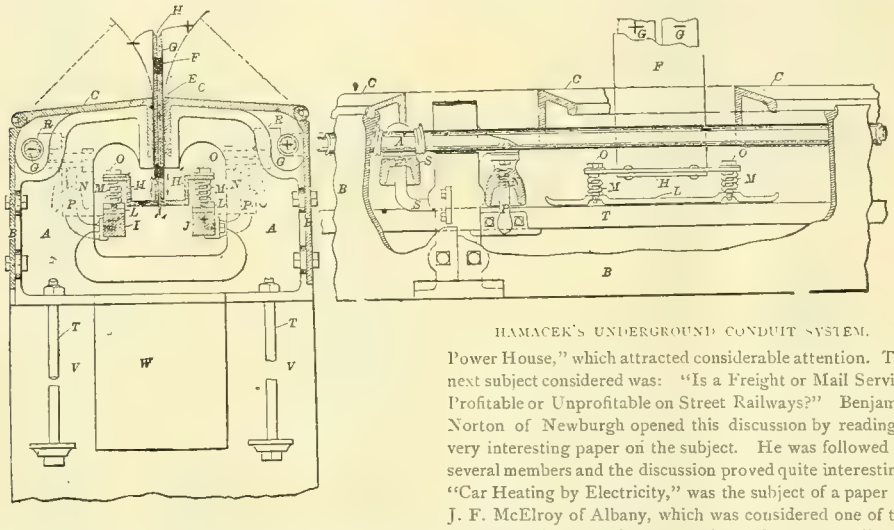
Numerous applications for new roads have been granted by the Railroad Commissioners, prominent among which is a franchise to the Auburn Inter-urban Electric Railroad company to build from Auburn through Port Byron and Weedsport. This road is to be about 25 miles in length, and will be the first electric railroad through a territory which in former years could only be covered by steam railroads.

The recent changes of steam roads to the trolley system all indicate a prosperous and extensive development of the street railroad interest of this state, which is pleasant to contemplate.

The report closed with a tribute to the memory of the late William J. Richardson, whose services in behalf of the association proved so valuable.

The report of the treasurer showed the following financial transactions during the year: Receipts, $7,286.57; expenses, $6,299.76; balance, $986.81. On motion, the report of the treasurer was approved.

This closed the routine business, and the reading and discussion of papers followed. The subject of the first paper was: "Are We Laying too many Miles of Track to Reach a Few People?" It was read by W. W. Cole of Elmira, and on motion the thanks of the association was voted the writer. H. S. Newton of Syracuse read an interesting paper on "Economical Equipment and Operation of Power House," which attracted considerable attention. The next subject considered was: "Is a Freight or Mail Service Profitable or Unprofitable on Street Railways?" Benjamin Norton of Newburgh opened this discussion by reading a very interesting paper on the subject. He was followed by several members and the discussion proved quite interesting. "Car Heating by Electricity," was the subject of a paper by J. F. McElroy of Albany, which was considered one of the best productions of the convention. C. Loomis Allen of Syracuse contributed a paper on "General Track Construction," and J. H. Barnard of New York presented a paper on "Signals on Electric Railroads." This completed the list of papers, and it was admitted on all sides that in this respect, at least, the convention had been unusually interesting and instructive.



HAMACEK'S UNDERGROUND CONDUIT SYSTEM.

There was an animated discussion on the subject of the admission of supply men as associate members, in which a number of representatives of supply houses participated, opposing the idea on the ground that it would not tend to the welfare of the association. The matter came up in the form of an amendment to the by-laws and was not adopted.

Resolutions expressing the thanks of the organization to the gentlemen who had prepared papers for the convention were unanimously adopted. Mr. Norton moved a rising vote of thanks to President Rogers for the successful efforts he had made during the year in bringing the association up to its present high standard. The motion was unanimously adopted. A vote of thanks was tendered to J. P. E. Clark of Binghamton for his efficient services as temporary secretary.

The attendants at the meeting were photographed in front of the Y. M. C. A. building. In the afternoon they visited the capitol and other places of interest in the city, and made an excursion to Troy under the auspices of the Albany Railway company.

In the evening there was a banquet at the Hotel Kenmore, which was well attended and was a very successful affair. At its conclusion three cheers were given for John W. McNamara, treasurer of the Albany Railway company, for his efforts in the entertainment of the visitors.

An interesting exhibit was made in a room adjoining the meeting hall. The meeting was unanimously voted the most successful in the history of the association, both in point of attendance and the interest manifested in the business proceedings.

The president appointed Messrs. Norton, Cole and Cooper a committee to nominate officers for the ensuing year, and upon their recommendation the following officers were elected: President, G. Tracy Rogers, Binghamton; first vice-president, W. W. Cole, Elmira; second vice-president, John H. Moffitt, Syracuse; secretary and treasurer, Benjamin Frick, Brooklyn. Executive committee, H. H. Vreeland, New York; John W. McNamara, Albany; Henry M. Watson, Buffalo.

The meeting adjourned to meet in Binghamton on the second Tuesday in September, 1896.

## Hamacek's Underground Conduit System.

The accompanying cut shows a transverse and a longitudinal view of an underground railway conduit, the invention of Adolph Hamacek of Sturgeon Bay, Wis. It is easily understood that unless the conduit is accessible for repairs, difficulties must sooner or later arise through dislodgment, the accumulation of dirt and other causes. And it is a fact that not withstanding the many apparent advantages of the underground conduit, the crude and improper application of the principle, resulting in great expense of repairs, delays in the service, and other inconveniences both to the owners and the public, have led largely to its abandonment. The conduit represented in the accompanying cut is designed to obviate these defects.

The entire length of the conduit is accessible for internal manipulations by merely raising the covers *C C*. These covers are self-locking and at the same time when closed form the slot rail. The whole conduit is very simple in construction. It is made throughout of cast-iron, is 18 inches high, 24 inches wide and weighs about 150 pounds per lineal foot.

In the cross section *A A* is the frame of the conduit upon which the covers rest, and to which is bolted *B B*, forming the sides of the conduit and the hinge of *C C*, the cover. The cover and sides are in sections extending from center to center of the frame, and may be of any desired length.

The cover is supported as follows: At the end of the section by resting directly upon the frame, at the inner sides by the rib extending the whole length of the cover and resting on a seat in the frame, at the outer edges by a continuous joint the whole length of the sides, as is shown in the cut. *E E* is the slot through which passes *F H H*, the arm connecting with *L L*, the shoes which form the contact with *F* (or *I J* in sectional view), representing the trolley rails. *G G* are insulated feeders, which deliver the current to the trolley rails by means of *R R*, the cut-outs. *M M* are springs designed to compensate for any unevenness of track and to keep up constant contact between the shoes and trolley rails. *O O* are bolts passing loosely through *H H* and *M M* and fixed rigidly in *L L*. *N N* (and the upper *S* in longitudinal view) are insulators. The lower *S* in the longitudinal view is a bracket supporting the insulators. *P P* are brackets to hold the trolley rails in position. *V V* are masonry or timber, and *T T* are anchor bolts. *W* is open space for accumulation of dirt falling into the conduit.

Among the advantages claimed for this invention are the possibility of using higher tension currents than is permissible in the overhead trolley, thereby greatly diminishing the cost of conductors and first cost of construction; it avoids the high earth resistance usually encountered by the ground return system; the system obviates all trouble to gas mains, water mains, telephones and telegraphs, usually caused by ground returns; in case, by any accident, one of the trolley rails becomes grounded, the motor will take current from the not-grounded trolley and carry the car over the disabled point, the same as in case of a single trolley, thereby obviating delay or repairs to be made immediately; in cases of necessity repairs can always be made quickly and with small expense; this conduit can be used with the single trolley, or ground return system, if found in particular cases desirable.

## A Floating Pillar of Light.

One of Mr. Stieringer's electric light decorations at the Atlanta exposition is thus described: The designs disclose a unique structure in the form of a pillar, or column, of considerable height. This is to be erected on a large float, and when completed, placed in position at the east end of the south side of the grand basin. Current is to be supplied to it by means of a cable submerged in the lake which will be furnished by the New York Safety Insulated Wire company. The unique structure will have arranged on the cap of the pillar a fancy grouping of incandescent lights to serve in lighting up the lake in that section. On the shaft, however, is where the fancy may be indulged. This comprehends over a thousand incandescent lights. These are arranged in spirals that will appear and vanish with kaleidoscopic effect and will fairly make this pillar revolve. If the structure will prove to be as handsome as the design, the pillar will certainly be a beautiful object aside from the fact that it is to be further reinforced with this marvelous display of lighting effects.

## Electric Welding and Soldering by Dr. Zerener's Process.

Three principal methods of uniting metals by electricity have been recognized, according to *L'Industrie Electrique*, the process of Dr. Zerener being the fourth and latest.

Prof. Thomson's method depends upon the direct transformation of electric energy into heat energy at the point where the union is to take place. Alternate currents are used. The high temperature attained, because of the resistance offered, renders the metal soft and malleable, but a generator of high power is required, while the secondary current used must be capable of great intensity with very low voltage. Iron wires, cables, bars, rails, etc., may be welded by this process, but plates of considerable surface cannot so well be manipulated, because of the impossibility of covering the necessary space with currents of the proper strength to produce the heat required.

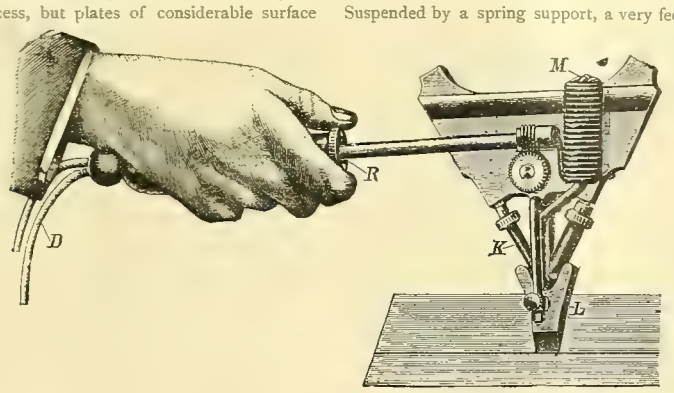



FIG. 2. ELECTRIC WELDING AND SOLDERING BY DR. ZERENER'S PROCESS.

The process of M. de Benardos is nearly contemporaneous with that of Prof. Thomson. In this process the heat of a voltaic arc is utilized upon the article to be manipulated, this last being brought between the arc, which is the positive, and the negative pole, which is of carbon, in case the object is of iron or steel, and the reverse contacts being made for other metals. The current used is a continuous one and may reach 1000 amperes.

Of a later date than either of the preceding is the system of Messrs. Lagrange and Hoho, which is not dissimilar from that of Planté in 1885. They do not utilize the voltaic arc direct, but like Thomson, the heat developed by the obstruction offered to a current by resistance. The resistance is produced by a hydrogen medium surrounding the object to be treated, which is in a bath of water connected with the opposite electrode. This process is evidently unavailable for plane surfaces. Each of the three processes so briefly described presents serious objections to its use, partly from the high currents used and partly from its limited application.

The process of Dr. Zerener is claimed to be exempt from these objections. The heat of the arc is utilized, as in the Benardos system, but the two poles are two carbons, instead of making the article to be treated one of them. By adjusting these the distance permits of a greater range of surface, regulates the intensity of the current, and the consumption of energy as well, while the metal is not consumed as part of the arc. An ordinary arc cannot be well utilized for heating purposes, without very closely approaching the object treated. Dr. Zerener has overcome this difficulty by arranging the two carbons in "V" shape, and submitting it to the action of a magnetic field developed by an electro-magnet, which forces the arc downward toward the angle of the "V." In these conditions the arc takes the form of a dart. This projected flame has a temperature nearly equal to that of the arc proper, and is readily available for welding.

One model of the apparatus has been constructed with hand regulation, while larger ones have an automatic regulator. Either continuous or alternating current may be used.

Fig. 1 represents the hand apparatus. The weight is not over one kilogram. The arc is regulated by hand by turning the thumbscrew *R* forward or back, thus changing the length of the arc to suit the requirements of the case.

The spools *M* of the electro-magnet are branched in series with the arc, enabling the operator to obtain a pointed flame at will, a flame of high temperature, which can be directed immediately on the point of the metal where the junction is to be made. The wires *D*, shown below the wrist of the operator, lead to the carbons as in an ordinary arc lamp. The apparatus is very effective with a minimum current of 15 amperes at 40 volts, and when necessary a maximum of 2,400 watts may be reached. The apparatus may be used for welding or brazing small pieces of iron, copper, silver, etc., without the intervention of any preparation.

When the current required for brazing reaches 40 to 60 amperes a flux of borax is used. This process has been applied in the manufacture of bicycle frames without in the least injuring the steel.

The automatic regulated apparatus is built upon the same general principle. Constant potential current is used, the solenoid producing the field is excited in derivation with a current of 15 amperes. The arc absorbs 100 to 200 amperes with a difference of potential of 70 volts. This model is used for welding iron, and will weld plates of five millimeters thickness. The plate is placed upon a piece of iron, the two lips to be welded being separated about two millimeters. The apparatus being thus disposed, the extremities of the carbons are held a short distance from the plate. Suspended by a spring support, a very feeble effort on the part of the workman suffices to graduate the distance from the point to be acted upon. Small pieces of soft iron are melted between the plates to be joined, and the junction hammered smartly during the cooling process. The work is thus accomplished in sections of about two centimeters.

The employment of an arc between two carbons permits of limiting and regulating the consumption of current. An arc of three amperes and one of 200 amperes have the same temperature, and it is only the quantity of heat disengaged which varies. According to the needs of the case the intensity of the current may be regulated—a regulation which covers from the minimum of three amperes to a maximum of 200 amperes.

The expense of installation is much less than that of either of the others mentioned, and there is no need of an accumulator battery, while the ordinary current of a lighting or power plant may be made available.

The handling of the two styles of apparatus mentioned is simple, and the limits of their usefulness are quite extensive, covering large as well as small applications. They are well adapted for the welding up of half-finished pieces, such as the barrels of guns, the parts of torpedos which require to be drilled and subsequently welded. Such applications are preferably done by the electric arc, since the action of fire is more or less destructive to the metal.

A process in vogue in America is quite similar to that of Dr. Zerener, inasmuch as the Coffin system utilizes the arc formed between two carbons, and the solenoid is also made use of to direct the flame upon the metal. The question of priority is not to be discussed here.

The Zerener process is particularly applicable to metal of minimum thickness, such as plates or sheets, and tubing, and for correcting faults of castings, but cannot be made available for bars of large cross section, such as shafting or street rails.

A soldering iron electrically heated is shown in Fig. 2, which weighs complete about one kilogram. This, as will be seen, is the same in principle as those referred already to, the heat being applied upon the copper *L*, which constitutes the soldering bolt proper and which may be of any required shape or dimensions.

The regulation of the arc is accomplished by hand as before; the iron is kept at a proper temperature, and may be readily manipulated for the soldering of tin or other metals where soft solder is used. The current is led to the apparatus by the wires *D*, and the consumption of current is from a minimum of three amperes at 40 volts and a maximum of 10 amperes at 60 volts.

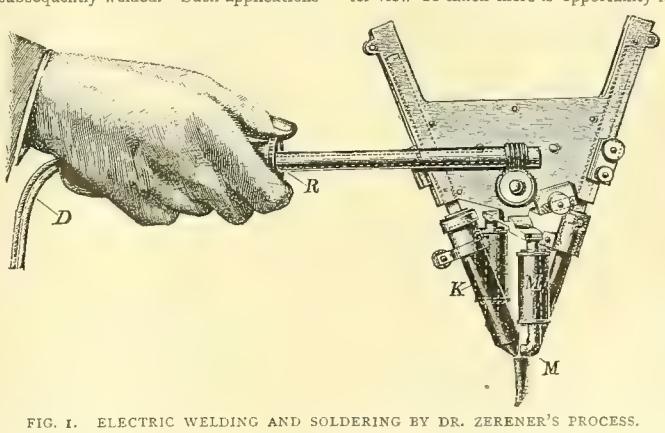



FIG. 1. ELECTRIC WELDING AND SOLDERING BY DR. ZERENER'S PROCESS.

## Ownership of Rails in the Streets.

[From the *Chicago Chronicle*.]

There is material interest in the latest contention of Congressman McGann and his associates in a certain electric railway in the south side of town.

Some months ago McGann and his associates, being possessors of a road which, very unfortunately, begins nowhere and ends at the same place, undertook to run their cars into the commercial center of the town over another corporation's road. The car they sought to dispatch in this direction was seized and absolutely demolished by agents of the corporation over whose rails they sought to carry it. Suit being brought against the wreckers of the car, a court decided that there was no excuse, nor did there exist any right, for one street car company to attempt to use the rails of another street car company, even though those rails were laid in the center of a public street.

Defeated at this point, McGann's company now adopts a sort of negative argument. It has a road on West Twenty-second street used very largely by the teams of large lumber and manufacturing concerns doing business along that street. Any man who will attempt to ride on a West Twenty-second street car will find that there are ten lumber wagons to one car occupying the tracks. The tracks are smooth and level. The street is rough.

It appears that there is, so far as promulgated, no law to prevent the private teamster from utilizing the level iron rails laid down by the street car company and thereby saving himself the rough haul over the street. In passing, it may be noted that the same situation exists everywhere in Chicago. Where there are street car rails teamsters, cabmen and drivers of omnibuses utilize them. Indeed, there doesn't seem to be any reason why they should not be so utilized, for these rails take up part of the public thoroughfare and the people professing to own them paid nothing for the privilege.

Now, the iconoclastic owners of this Twenty-second street railway have set up two propositions. To begin with, they said that all the rails laid in the public streets might be used by the general populace. To this theory they tried to give practical effect. Being suppressed, by judgment of Judge Tuley, they now set up the doctrine that rails laid by a street car corporation in a public street may not be used by the general public.

Surely one contention or the other must be right. Certainly if a cabman, charging his fare 50 cents, may turn gayly into the tracks of, let us say, the South Chicago City Railway company and dash speedily southward on them, it ought to be entirely proper for a hard-working man who has possessed himself of a vehicle which will carry not two, but 20 people, to drag them along the same tracks at an expense of 5 cents apiece.

It would really seem that the courts of Cook county are on the horns of a dilemma. Either they are compelled to assert that no vehicle may drive on the tracks laid by a street railway corporation or else they certainly must assert that all vehicles may. It occurs to the *Chronicle* that if the latter view be taken there is opportunity for individual enterprise to break down corrupt monopoly, and that if the former be adopted there are not enough policemen, militiamen or other officials of the law in Chicago to enforce it.

## Electrical Journalism in Canada.

We extend our congratulations to our contemporary upon the very creditable production which it has just issued in the form of special convention number of the *Canadian Electrical News*, containing an article descriptive of the electrical features of Ottawa, the programmes of the Canadian Electrical association convention and the convention of Stationary Engineers. The illustrations are good and everything about the journal indicates prosperity and advancement. C. H. Mortimer, the publisher of the *News*, is one of the best known men in Canadian electrical circles and his popularity is deserved.

The Florence, S. C., electric light plant has been remodeled and now in operation on a larger and greatly improved scale.

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IT is generally admitted that Japan has been quick to take advantage of electrical applications in her mining industries. Although the cheap labor is rather an obstacle to the installation of power plants, they are making headway, and, judging by the figures recently given out of the value of Japan's electrical imports, this country is gaining the business very rapidly. According to a German authority, the value of dynamos exported from Germany to Japan in 1892 was 73,741 yen, which far exceeded that from Great Britan or the United States; in 1894, however, those imported from Germany amounted 18,120 yen, from England 49,222 yen and those from the United States 145,200 yen.

IN the course of an interview with Mayor Swift of Chicago, telegraphed from New York last week, that gentleman is reported to have said that if the statement regarding the operation of the Lenox avenue underground conduit road proved true, he would insist upon the Chicago street railway companies substituting a similar system in this city in place of the present equipment. Possibly Mayor Swift may be satisfied in his own mind that six weeks' experience with an underground conduit system for street railways will demonstrate the practicability of the proposed plans, but he will find it hard to convince street railway managers, and this of course is the essential feature of the scheme. The mayor's experience should teach him that his wishes alone will not cut much of a figure in the settlement of such a problem as this.

OVERHEAD wires have been prohibited in the streets of the downtown business district of Chicago for many years and every attempt to penetrate that portion of the town known as the retail district has been vigorously opposed. Now, another effort will be made by the Chicago City Railway company and the business men of South Clark streeet to have the trolley line extended from Adams street to Washington street. In the original ordinance it was provided to have the northern terminus of the line at Washington street, but the mayor vetoed the franchise and a compromise was reached, the company accepting an ordinance that gave it the right to build a trolley line as far north as Adams street. In preparing for this change of motive power on South Clark street, it was noticed that the company bonded its tracks as far north as Washington street and it was surmised that a trolley line would eventually be built to that point. It was not a surprise, therefore, when the announcement was made that an ordinance had been introduced amending the franchise now held so that the line could be continued to Washington street. It is charged that the company has not kept faith with the mayor; that an agreement was made by which Adams street was named as the northern terminus of the line, and it is further charged that the company attempted to "sneak" the ordinance through the council without attracting attention. However, it is claimed that the property-owners and business men renting offices and stores on South Clark street, demand the extension of the trolley to Washington street and if this should be demonstrated we can see no reason why the franchise should not be granted.

ONE of the "arguments" which the present administration at Washington advances in support of its position on the Hawaiian cable project, is that the present business between this country and the islands would not support a cable. "It is certain that no cable will be laid as a private enterprise, because it will not pay," says the Chicago *Chronicle*, and it adds: "The commercial business of the islands with the rest of the world is not large, and it is almost entirely of a kind that can be transacted about as well without as with the aid of a telegraph, except, perhaps, for a short time in each year when sugar is ready for market. Commercial business and press business, except, perhaps, in times of political disturbance, would not pay a half of 1 per cent. on an investment of $1,000,000. Government must practically guarantee all the interest on the investment or no cable will be laid." It is admitted that it might be advantageous for this government to control the cable to Hawaii in case of further political changes in the islands. "In case of annexation cable communication would become almost a necessity. The government would have to bear the entire burden either directly or by guaranteeing interest on bonds. But if the islands remain independent the burden may be shared by other governments. Honolulu is so situated as to make it a valuable telegraph station for political and war purposes, although of no very great value as a commercial telegraph station. It will be utilized for that purpose, no doubt, at no very distant day, and cables may be laid thence to Japan and Australia. But our government need not make haste to connect itself to the financial support of those undertakings." Here is a brilliant foreign policy. Had not a change been made at Washington it is quite probable that a policy very similar to that indicated would have been followed. The change came none too soon. The record of the last Congress on the Hawaiian cable project is a disgrace to the nation.

FOR more than a year the city of Milwaukee has been the scene of a lively controversy over the advisability of establishing a municipal lighting plant. Now, it is reported, there is fair prospect of a settlement that will be satisfactory to the people and to the company which has heretofore furnished light for the city's streets. One of the most earnest and zealous advocates of the plan for municipal ownership, the city engineer, admits that the project is not feasible at this time, lack of funds and time making it absolutely necessary for the city to dismiss the subject for the present. He says, too, that it would require considerable time to establish a comprehensive lighting plant for the city's streets, far more time than is now at the disposal of the city. The local company that has been furnishing the city lighting does not care to make a contract for less than five years. In case the city should decide to proceed at once with the project of building a plant of its own, it would be necessary to go back to gas lamps for the period that would intervene between the expiration of the present contract and the completion of the municipal plant. The city engineer recognizes the objections to this course. He realizes that such a step would be very unpopular and he very wisely advises the council not to create prejudice in the public mind against the city's scheme by making this mistake. He believes it would be better to wait five years under the circumstances. This admission on the part of the city engineer is significant. It disposes of the assertion that the company at present furnishing the street lighting does not give good service. Then the only reason that can be assigned for building a city plant is that a saving might be effected. But can this be done? Has the city engineer had any new light on this subject? At the present prices for labor and material it is admitted by the Milwaukee advocates of the project that they cannot put in a plant that will compete in economy with the existing company's service. It has been shown that similar movements elsewhere have failed. Chicago should serve as a warning to all cities ambitious to own and operate their own plants. It would pay the city of Chicago to shut down the stations constructed under City Electrician Barrett's direction, throw out the entire equipment, and buy its lights from a commercial company. By such an arrangement the city could have its streets well lighted, something unknown under the present inefficient administration. To-day the city is paying out considerable money for which it gets absolutely no return. The city of Milwaukee should take warning and avoid having a similar weight saddled upon it.

TWO conventions of more than ordinary importance were held last week and the proceedings of both are reported elsewhere in this issue.

The gathering of street railway men at Albany may be considered an electrical convention in every sense, not only because the great majority of the companies comprising the state association operate electric roads, but because the sessions were given up almost entirely to the consideration of subjects affecting electric railway interests. It is not often that such able papers on technical subjects are presented at meetings of minor associations as those read before the Albany gathering last week, and it may be said with truth, too, that there are very few industrial assemblages where subjects requiring such exact information would be discussed with so much intelligence and skill as was shown in that meeting. This is not at all surprising to those familiar with the street railway business and the men engaged in it, but the general public has no idea of the magnitude of the interests involved. It may be said that the public has an exaggerated notion of enormous profits derived from these properties and a very inadequate idea of the investment required and the skill and carefulness demanded in the management of these vast interests. In the address of the president of the New York association some statistics were presented that show in a measure the importance of the industry represented at the Albany meeting. "We now have in this state about 1,400 miles of track and an investment of upwards of $200,000,000," is the statement by the president, of the equipment and valuation of the plants represented by that body. "We carry every year seven times the population of the entire United States and over one-third the population of the entire world—over 500,000,000 of passengers annually—while the steam roads carry but 160,000,000. The gross receipts of this street railroad traffic are about $25,000,000." Very few people realize what this means to the community.

The other convention alluded to was the meeting of the Canadian Electrical association at Ottawa. This, too, was a successful gathering, and the men who participated in the deliberations of the organization were among the most progressive citizens of the Dominion. They represented every branch of the industry, and their investigation covered a wider field of operation, but it was noticeable that among the topics considered, on account of their commercial importance, special attention was given to a subject that occupied a prominent place in the proceedings at Albany. Legislators in Canada, as in this country, are prone to enacting laws that often greatly retard the developments of some particular industry without offering any compensation in the way of advancing the public welfare. Of course all measures of this kind are supposedly in the interest of the people, but many of them are prompted by far less worthy motives. Thus far the New York association has been able to guard against the attacks directed against the members at Albany, but the Canadian association is still experiencing some annoyance from the activity displayed by the lawmakers of the Dominion. Only admirable organization and constant care can protect the interests involved either in the Empire state or across the border. It is gratifying to note that both organizations realize the gravity of the situation and are preparing for emergencies.

## Municipal Lighting in Milwaukee.

[From the Milwaukee correspondent of the WESTERN ELECTRICIAN.]

The municipal lighting project for Milwaukee seems to be dead, and there is now little doubt that the Milwaukee Street Railway company, which owns the Badger illuminating plant, from which the city has heretofore been supplied, will again get the contract for lighting the streets of the city, and the probabilities are that the contract will be made for a period of 10 years or more. Such an arrangement would be, it is believed, for the best interests of the city, and of course it would likewise be considered a great victory for the company as well as a valuable deal for financial reasons.

Some days ago City Engineer Benzenberg, who has shown a great deal of interest in the municipal lighting project, announced that owing to lack of money and time, principally the former, the city could not build a lighting plant for a period of five years, and that the wisest course for the city to pursue would be to make the best terms possible with the Milwaukee Street Railway company. Mr. Benzenberg now estimates the cost of a municipal lighting plant at $400,000, which takes into consideration the increase in the price of labor and of machinery and other iron products. Even if the city had the money, the city engineer admits, the people of the city would not be willing to go back to gas for the period that would be required to build an electric plant, and the Milwaukee Street Railway company, which owns the only public electric lighting plant in the city, had not made a bid to furnish light to the city for a shorter period than five years. After making the new contract for light, the city engineer said, the city could go ahead and make the plans for a lighting system of its own to be ready by the time of the expiration of the new contract. The matter, he said, should not be allowed to lie in abeyance for another five years, as that could place the city in the same predicament in which it is in this year. Just as fast as pavement was ordered for a street the Common Council should pass a resolution for the laying of city lighting mains in that street before the other work was begun. In this way the city would have quite a complete conduit system at the end of five years. Two years before the expiration of the contract, work on the plant itself should be commenced. The city could build conduits more cheaply than the present company did, for the reason that the city would know in advance just where its lines were to be run, whereas the company has put down a main in one street only to find that another street for which lights were ordered could be most easily supplied from the first street, the conduit in which would thereupon be torn up and new mains of sufficient size built in their place. The city, moreover, would be able to get the most improved machinery for its plant, and at lower prices than the cost of machinery in the Badger plant.

There was quite a lively time when the matter came up before the Common Council committee on street lights. The friends of the Milwaukee Street Railway company, seeing their opportunity, came forward very promptly with a proposition to award the company a contract for a term of 10 years. On the basis of a five-year contract the company had bid $109 a year for lamps supplied by a conduit and $92 a year for lamps supplied by overhead wires. On the basis of a 10-year contract the company had bid $105 a lamp, conduit system, and $87 a lamp, overhead system. Of course, if the city did not contemplate building a plant of its own the 10-year contract might be the most advantageous one for it, but under the circumstances the awarding of such a contract meant the postponement of the city lighting project for 10 years.

A resolution was introduced to award the contract for 10 years, the price to be $105 a lamp for the conduit district, within a radius of two miles of the power house of the Badger company, all lamps on overhead circuits within such radius, however, to be $87 a lamp, and the price outside such radius to be $87 a lamp, whether the lamps were fed by the conduit system or the overhead system. It appears that the Badger company, in complying with the ordinance for the burying of its wires, has left some overhead wires within the radius prescribed and has laid some conduits outside of the territory. Alderman Williams, who is one of the strongest supporters of the Milwaukee Street Railway company in the Common Council, at once spoke in favor of the proposition, declaring that the city had never received such a favorable proposal to furnish electric lamps. Alderman Muenzberg, on the other hand, said that he was not in favor of binding the city to such a long contract at such a high price. If the city were going to repeal the conduit ordinance and permit overhead lighting, why did it not get a bid from Captain Pabst, who has a large power house on Broadway, with conduits for his own buildings in the down-town district, and who could string wires so as to light the city? Alderman Muenzberg advocated awaiting the return of Captain Pabst from Europe. Alderman Ramsey and Alderman Bryden lost no time in ranging themselves alongside of Alderman Williams. Alderman Bryden said that he did not see how electric lights were to be any cheaper for years to come. "Is labor," he asked, "to be any cheaper, or is there likely to be any great decline in the price of coal?" Alderman Williams attacked the municipal lighting project and Alderman Muenzberg defended it. Finally Alderman Muenzberg offered as a substitute a resolution instructing the Board of Public Works to advertise for new bids. The substitute was lost by a vote of five to three. The original resolution was thereupon adopted.

Two reports were prepared for the Common Council. One recommended that new bids be called for, some of the aldermen believing that Captain Pabst, who had just returned from Europe, might be induced to make a bid for supplying street lights to the city. The majority report, of course, recommended the awarding of the contract to the company for a term of 10 years. Lamps in the district in which underground conduits are maintained are to be paid for at the rate of $105 a lamp a year. This territory is included within the boundary which begins on the lake shore at Maple street, runs west on Maple to Hanover, northwest to the corner of Sixth avenue and Lapham street, northwesterly to Fifteenth and National avenues, northerly and northwesterly to the corner of Sycamore and Twenty-fourth streets, northerly to Chestnut street, northeasterly to the corner of Lisbon avenue and Galena, northeasterly to the corner of Seventeenth street and Fond du Lac avenue, northeasterly to Fourteenth street and North avenue, northeasterly to Third and Clark streets, easterly to the corner of Newhall street and Summit place, and thence east to the North Point Pumping works. Lamps in this district on overhead conduits, the majority report provided, should be paid at the rate of only $87 a year. All lamps outside of this district, whether the underground or overhead system were used, were to be paid for at the rate of $87 a year. The report also provided that whenever, at the order of the Common Council, any of the wires within the district which are now overhead are laid in conduits, the price of lamps upon such circuit shall be increased to $105 a year.

The majority of the committee also recommended that it be made a condition of the contract that the company obligate itself to sell its arc light system, including the power house on Commerce street and the site which it occupies, to the city in case the city should decide that it would operate its own lighting plant. The price of the plant in such event, the report provided, should be agreed upon between the city and the company; and in case of disagreement, it should be determined by an arbitrator appointed by the mayor, by another arbitrator appointed by the company and by still another to be chosen by these two. It was provided in the report that the city should give notice of its intention for the purchase of the plant at least one year before the expiration of the contract, and the company should modernize its power plant and reconstruct it to the satisfaction of the city engineer and the board of public works of the city.

At the last moment the committee decided not to submit its report to the Common Council at its meeting Monday afternoon. The cause of the delay was a determination to hold another meeting of the committee for the purpose of considering a proposed change in the time for the purchase of the Badger plant. The new proposition was to enter a contract for the lighting of the streets for a period of 10 years, at the prices already stated, upon condition that the city be allowed at the end of five years to purchase the plant in the manner first agreed upon for its purchase at the end of 10 years, by giving one year's notice. The provision to be made is that the plant shall be kept up to the highest standard during the next four years, and that when it is transferred to the city, if it is transferred, it shall be equipped with the most improved machinery known at that time. The company is said to be willing to enter into a contract upon these conditions. The proposition, it is quite likely, will receive support that the other proposition would not have received. Meanwhile, Captain Pabst is considering the matter of making a bid on the electric lighting.

A day or two after the time fixed by the board of public works for receiving proposals for electric lights had expired, the board found in its mail a proposition from John S. Gersting of Williamsport, Pa., to furnish arc lights to the city, his figures being $155 a lamp for one year, $140 a lamp for two years, $120 a lamp for five years and $105 a lamp for 10 years. The figures for five years were $11 a lamp a year higher than the corresponding figures of the Milwaukee Street Railway company. The proposition was rather mysterious, to say the least, coming late and not being made in the regular form. Gersting wrote that if his proposition were accepted he would forward a certified check in any amount that the board might designate. His offer to furnish lamps at $155 a year for one year excited considerable comment, in view of the fact that he would have to erect a plant for the special purpose of lighting city streets for that short period. No attention has been paid to the bid.

## Canadian Electrical Association.

Last week was an eventful one for the electrical fraternity of Ottawa and the Dominion, as the annual meeting of the Canadian Electrical association was in session in the capital city. The attendance was large and of a representative character, and the proceedings were interesting throughout. On Tuesday morning, September 17th, the business of the convention was begun by the formal opening, which took place in the railway committee room of the House of Parliament, when Mayor Borthwick read his address of welcome.

K. J. Dunstan, local manager of the Bell Telephone company of Toronto, who is president of the association, replied. He expressed the thanks of the convention to the mayor and the city of Ottawa generally for their cordial welcome. He said that if the convention of the Canadian Electrical association met in Ottawa in 1915, the then mayor and the citizens of Ottawa would be able to look back at the wonderful strides of electricity as a motive power and as a lighting agent, and would then also be able to look forward to still greater possibilities for the future, just as the people are doing to-day.

The visitors were then conducted over the House of Commons and Senate buildings, as well as all their adjuncts—the restaurants, the speaker's chambers, the library of Canada, as well as other places of interest, Messrs. W. Y. Soper and C. Berkeley Powell acting as cicerones, assisted by Deputy Sergeant-at-arms Bowie and Harry George.

At 2:30 o'clock the first session of the convention was held in the Board of Trade chambers. There was a very large attendance of ladies and gentlemen, including members of the association and the general public when President Dustan delivered his address. He alluded to the general depression in trade and commerce from which the electrical world did not escape, and spoke of electrical railways, saying that "at the last session of the Ontario Legislature there were incorporated no less than 12 electrical railway companies. This fact alone gives a fair indication of the great activity in that particular branch of applied electricity." Continuing on this subject he said:

One of the most important electric railways opened for traffic during the past year is that known as the Hamilton, Grimsby & Beamsville railway, running from Hamilton to Grimsby, a distance of about 18 miles. It is not only the longest road of the kind in Canada, but it is exceptional on account of the large amount of freight which it handles.

On every hand throughout the whole country we now find similar electric roads projected or under discussion; towns and villages are being connected with the result that this cheap and easy means of local transit, together with the intercommunication afforded by the telephone, will go far to break down that isolation which makes farm and country life so distasteful to the younger members of the community.

Speaking of electric lighting, Mr. Dunstan continued:

The question of municipal control of city lighting was fought to an issue in Toronto in a contest remarkable for warmth and energy. Every effort was made on both sides to educate the people in the way they should go—to the polls—the result being that the by-law to provide funds to erect the civic plant was defeated by a vote of 8 to 1.

Last year the Wellsbach burner formed a slight unsettling element in the lighting business, there being those who felt the greater efficiency of this burner would, by cutting down the cost, injuriously affect electric lighting interests. Those fears have proved to a very great extent to be groundless, but we find this year a new disturbing feature in the form of acetylene gas, but to what extent it will become a live issue yet remains to be seen.

Whatever the outcome, electric light men must face the fact that prices from competition or other causes have a downward tendency and this tendency must be met with improved methods of production.

A feature of the afternoon meeting was the reading of a paper by A. A. Dion, entitled "Some Notes on the Consolidation of Two Systems of Electric Supply." The speaker gave the details of the amalgamation of three electric light companies, the Ottawa Electric Light company, the Chaudiere Electric Light & Power company and the Standard Electric company of Ottawa.

The paper read by Charles P. Dwight on "The Telegraph in Canada," proved a most interesting history of that department in the Dominion, and made a third of the series already in the possession of the association. After referring to the organization of several companies Mr. Dwight said probably the first telegraphic connection enjoyed by Ottawa was in 1850, when the Montreal & By-town Telegraph company's line was built. Edward McGillivray was president of this company, which in a few years was purchased by the Montreal Telegraph company, and this in turn in 1852 purchased for $11,000 the line between Buffalo and Quebec owned by the Grand Trunk Telegraph company.

The report of the committee on legislation contained the following information:

During the last session of the Ontario Legislature a bill was introduced, which, if it had become law, would most assuredly have worked an injustice to many, and would have been burdensome to all who have invested their capital in electrical enterprises, by laying a tax as personality upon all

street equipment of electrical companies. Immediately upon the introduction of the bill your president called a meeting of the executive committee, when a circular was drafted and sent by the secretary to all the electric light companies in Ontario. As a result of this circular we have reason to believe that a large number of the representatives who compose the House had information placed before them in the most effective way that the proposed legislation would work an injustice, inasmuch as it would enable municipal councils to make a breach of the understanding on which nearly all the electric companies of the province were were organized; that in many cases where the business is barely self-sustaining, under the present conditions such taxation would prove so burdensome that it would mean the practical confiscation of the plant; that instead of proving a benefit to the public the result would be exactly the reverse, as many companies which are organized not with a view to profit, but as a public convenience, would be compelled to suspend, thus not only causing a loss of investment, but depriving the country of its advantage. So forcibly were the conditions presented to the legislators that a large majority were convinced of the injustice and the bill was withdrawn. The matter of the municipal assessment in many of its phases presents a different problem, but in no feature is this more apparent than in its application to electrical interests. Your committee would therefore urge not only upon members of this association, but upon all who are interested in any way in electrical enterprises, a thorough consideration of the practical application of this question, and especially to see that their representatives in the legislature who may be called upon at any time to legislate on this subject have some knowledge of the interests involved, so that they may know the effect of ill-considered changes which may possibly be proposed.

It was decided to hold the next convention in Toronto in June next. Messrs. Smith, Toronto; McFarlane, Montreal; and Taylor, Ottawa, were appointed a committee to strike the standing committees for the ensuing year. The election of officers for next year resulted as follows:

President, A. B. Smith, superintendent of G. N. W. Telegraph company, Toronto; first vice-president, C. Berkeley Powell, Ottawa; second vice-president, L. B. Macfarlane, manager eastern department Bell Telephone company, Montreal; secretary-treasurer, C. H. Mortimer, publisher *Electrical News*, Toronto; executive committee: Warren Y. Soper, Ottawa; George Black, G. N. W., Hamilton; E. Carl Breithaup, E. E., Berlin; J. J. Wright, manager Toronto Electric Light company; O. Higland, Inland Revenue department, Ottawa; J. A. Kammerer, general agent Royal Electric company, Toronto; F. W. Badger, Quebec; Wickens, Toronto; John Carroll, Montreal, and K. J, Dunstan, Toronto.

## $500,000 Offered for an Indianapolis Railway Franchise.

The following unusual proposition for a street railway franchise has been made to the Board of Public Works of Indianapolis:

The Indianapolis & Broad Ripple Rapid Transit company, being anxious to secure a line of its own to some central point in the city of Indianapolis, and believing it to be for the best interest of the public that such right be granted, respectfully submit to your honorable board the following proposition:

1. If the city will grant to the Indianapolis & Broad Ripple Rapid Transit company any practical route from the northern limits of the city to Washington street on the same terms as are provided in the franchise known as the city railway franchise, the Indianapolis & Broad Ripple Rapid Transit company will accept it and carry the people to the park of the company at Broad Ripple for the sum of 5 cents.

2. The Indianapolis & Broad Ripple Rapid Transit company begs to submit to said board a separate proposition on the subject now under consideration by said board, and as follows: If the Board of Public Works and the City Council will grant to the Indianapolis & Broad Ripple Rapid Transit company a franchise to all the streets of the city and the rights heretofore granted to the City Railway company, to take effect at the time of the year 1901, when the franchise now held by the Citizens' Street Railway company expires, the said Broad Ripple Rapid Transit company will accept such franchise on the same terms as were incorporated in the franchise granted the City Railway company, and, in addition to the burdens and conditions imposed by the terms of said franchise to the said City Railway company, the Indianapolis & Broad Ripple Rapid Transit company will perform all the agreements provided for in said franchise to be performed by said company, and will, as soon as given the full possession of said streets, under said franchise, pay to the city an additional sum of $500,000 in cash.

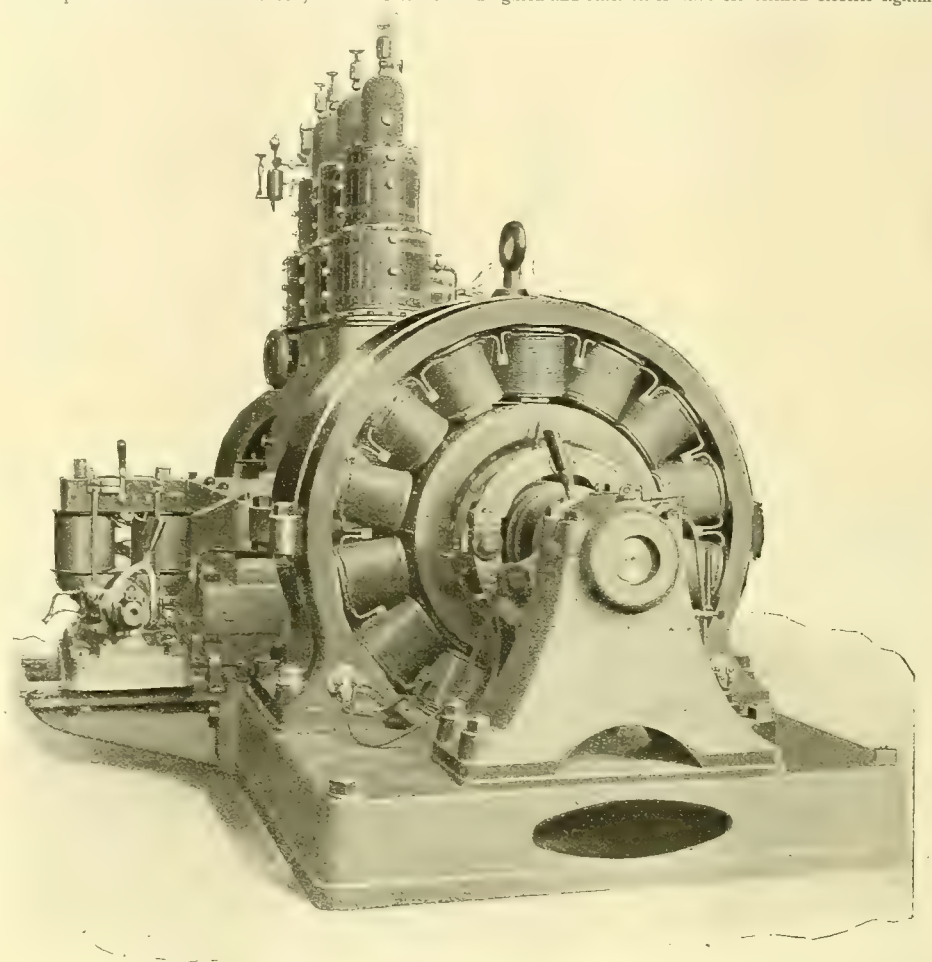
And on the granting to the Indianapolis & Broad Ripple Rapid Transit company a franchise to all the streets granted as above set forth, it will give bond now to the city of Indianapolis in any reasonable sum which the board may see fit to require, guaranteeing that it will carry out the promises made in the securing of said grant.

## A Combination that Failed.

Respecting the announcement from New York that the Metropolitan Traction company, which operates the cable and electric surface lines, had decided to adopt an underground system, a Chicago daily paper recalls the fact that Mr. Yerkes tried the experiment here and abandoned it, and that underground conduit on Fullerton and Webster avenues has been filled up and the cars are running there by an overhead trolley.

## Combined Willans Engine and General Electric Monocyclic Generator for the Lake Street Company, Chicago.

An interesting combination is the Willans engine and General Electric monocyclic generator here illustrated. The engine is of the central valve single-acting type of 150 indicated horse power capacity, and the generator is a special monocyclic machine of 140 kilowatts capacity. The combination was constructed for the Lake Street Elevated Railroad company of Chicago. The generator embodies all the best features of monocyclic practice. The armature core is built up of insulated laminations, and is provided with ventilating ducts through which the air may be rapidly circulated. The coils are made up separately and each, in case of accident, can be readily removed from the armature without disturbing the other coils. The supplementary coils connected to the power wire are placed in small slots between those occupied by the main coils. The pole pieces are built up of laminations of sheet-iron, and are cast into



COMBINED WILLANS ENGINE AND GENERAL ELECTRIC MONOCYCLIC GENERATOR FOR THE LAKE STREET COMPANY, CHICAGO.

the frame of the machine. This eliminates eddy currents in the pole pieces and lowers the magnetic reluctance of the field circuit. The bearings are self-oiling, self-aligning, and are designed with ample surface to secure cool running. Automatic regulation is secured to meet varying conditions of load by rectifying a portion of the main current and passing it through a supplementary field winding. The generator is designed to give the best results in general distribution, and is working without difficulty almost continuously.

## Electric Locomotives for Great Altitudes.

For railroading in great altitudes electric locomotives should have decided advantages over steam locomotives. A thorough test is to be made if the following press dispatch from Philadelphia can be relied upon:

A representative from the Baldwin Locomotive Works, with an expert electrician from the Westinghouse company, together with Sir Henry Tyler, ex-president of the Grand Trunk railway, will start for Peru, where, it is said, a test of the feasibility of the electric locomotive is to be made upon a railroad 15,000 feet above the sea level. Sir Henry Tyler has been in this city for several days in conference with members of the Baldwin firm, and it was decided to make the experiment. The party will start for South America from New York.

The Mexican Telephone company of the City of Mexico has 2,250 subscribers and a gross income of about $9,500 per month.

## Electrical Outlook in England.

I. N. Ford, the recently appointed London correspondent of the *New York Tribune*, has been comparing electrical development in the United States and Great Britain with the following result:

In both electric lighting and railways England is a long way behind America. When the British association met in Montreal 17 years ago Mr. Preece, the distinguished electrician, expressed surprise that so few adaptations of electric lighting had been made in American cities. During the long interval progress in electrical science has been very rapid in the United States and much slower in Great Britian. Outside London electric lighting is mainly confined to central circuits in large cities and has been introduced on a small scale. Cities which own and operate their gas plants have been reluctant to avail themselves of electrical supplies. Birmingham, while it has municipalized gas, has strangely armed an electrical company with lighting privileges for 30 years—a radical departure from Mr. Chamberlain's original policy. Leeds has followed Birmingham and permitted a private company to supply electric light to consumers in competition with municipal gas. Manchester, Oldham, Huddersfield, Bradford, Glasgow, Brighton and other cities have established electric lighting plants under municipal ownership and management. In Glasgow and Manchester this policy has been markedly successful. In Bradford also it has been a profitable municipal enterprise, a return of 10 per cent. being made to the town treasury upon the capital invested after payments have been provided for the sinking fund.

While English cities have, as a rule, been very cautious in introducing electric lighting they have been equally deliberate in adopting electric transit. The Isle of Man, which now has in operation electric lines from Douglas to Laxey and also to the summit of Snaefell, is in this respect in advance of other portions of the United Kingdom. In Birmingham, Leeds and a few other cities there are electric railways, and in South Staffordshire there is one which has been most economically constructed; but the trolley system has not been introduced on a large scale. Blackpoo has electric tramways under municipal management, but the success of the experiment has not yet been fully demonstrated.

While English cities are behind American towns in the adoption of improved methods of electric lighting and transit, there are some compensations for lack of enterprise. The charges to consumers for electric light in Bradford, where a superior system has been introduced by the Town Council, are very low, and in Manchester and Glasgow the best methods have finally been employed after an exhaustive investigation of principles and appliances. Electric transit when it is provided on an extensive scale may be free from some of the most objectionable features of the American system. Unless all signs fail, the municipalization of electric supplies is the coming policy in England. The town councils may eventually furnish electric power not only for lighting but also for the operation of machinery. Not only the municipalities, but county and district councils as well,

are moving rapidly in the same direction. Already there is a very strong movement in rural communities for the construction of light or electric railways at the expense of ratepayers for the benefit of the farming classes, and parliamentary legislation is eagerly awaited for that purpose. This is one of the newest developments of state socialism in Conservative England.

## American Electrical Equipment for South Afrjca.

Less than two years ago Buluwayo was a thatched town in South Africa, inhabited by a war-like Zulu tribe under the savage Lobengula. A few months only has sufficed to turn the kraal into a busy city, which has sprung up with mushroom like rapidity. It has just ordered from the General Electric company an electric lighting plant for the illumination of its streets, public buildings and private residences. This contract was secured in the face of the competition of the most noted manufacturers in Europe, whose foothold in South Africa was the surer, because it had been planted earlier and had been undisputed. The contract was secured entirely by correspondence and solely on the merits of its engineering plans and recommendations. The plant will consist of two McIntosh & Seymour engines, taking steam from Babcock & Wilcox boilers. The engines will drive two single phase high periodicity General Electric alternating dynamos. The lamps will come from the General Electric company's works, and thus a representative American plant will be established on the newest frontier of the new civilization in South Africa.

## Development of Electric Traction.

Addressing the Western Railway club in Chicago on September 17th, L. B. Stillwell of the Westinghouse company made these observations on electric traction:

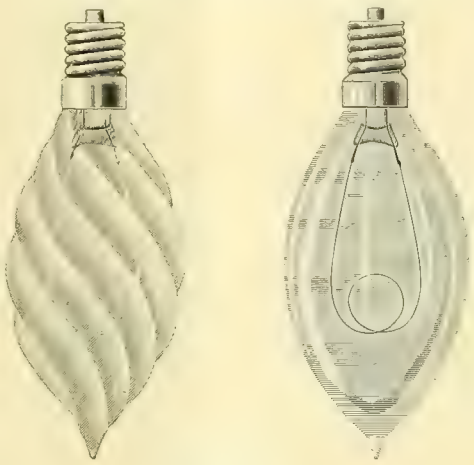
We are, I think, justified in concluding that a broad view of the situation indicates that electric traction is destined to generally supersede all other systems of traction in our large cities and their suburbs. To what extent electric traction will, in time, compete with steam in cross-country service it is yet too early to say, but if I may be allowed to express my personal opinion, I should say that where distances are great and traffic comparatively light, it will be a long time before steam locomotives are superseded. For the cities, however, the change cannot well come too soon. It is true that the best means of transmitting power from the central station to the moving car has not been conlusively fixed upon. The overhead trolley, the conduit, and the systems in which contact points under the moving car are charged as the car passes and discharged when the car has passed—these, and perhaps others, are to-day in practical operation, and in no small degree successful, but they have not been in use for a sufficient length of time to make it clear that any one is superior to its competitor—in fact, it is altogether probable that here, as well as elsewhere, we shall find that no one system is best for all cases; that various methods must be employed to meet different conditions.

A cross country electric railroad has just been completed between Carthage and Carterville in Missouri. The distance is 15 miles. Carthage and Carterville are in the center of the rich lead and zinc producing section of Missouri, and a great deal of mining machinery is scattered along the line of the road. If the line proves a success, it will be extended to Kansas City, 10 miles farther. The projectors propose to try in a limited way to furnish power to a mill on the line, and also to experiment in lighting farmhouses. The subject of furnishing power to threshing machines will be considered next year.

## Buckeye Lamps.

The Buckeye Electric company of Cleveland, O., has just issued a new and extremely attractive catalogue calling attention to its superior make of incandescent lamps, and showing new and decorative designs. This little book is certainly in its conception and in artistic completeness the most attactive trade catalogue issued in many days. It is neatly illustrated with original pen and ink sketches, varied and unique in character, and is a veritable little work of art.

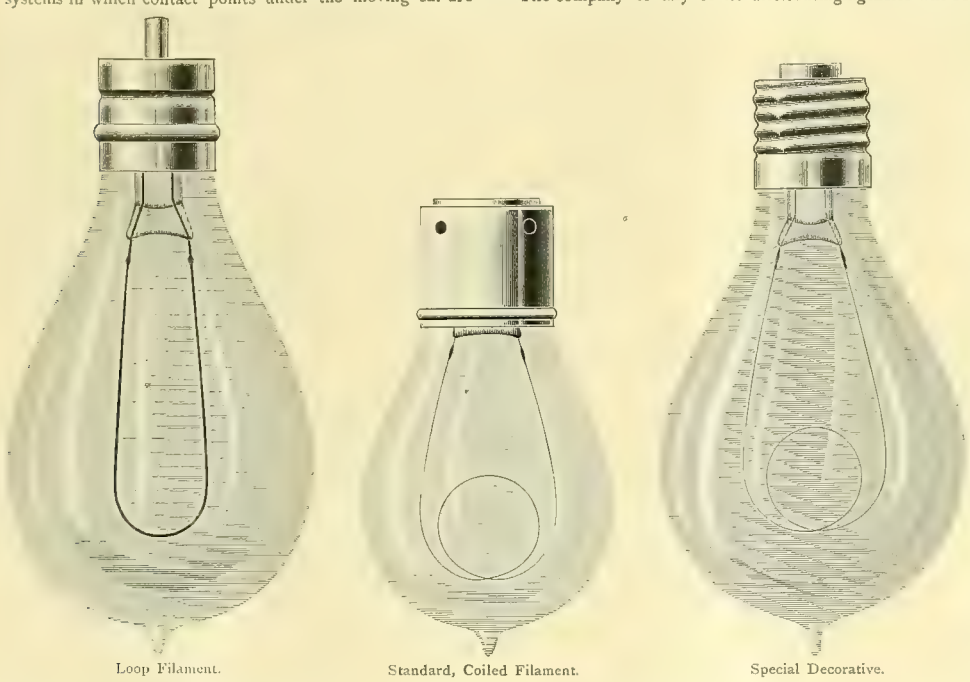
The company in its announcement takes occasion to call attention to the high position it occupies in the industry in which it is engaged and the uniform excellency of its products, in which its efforts are constantly in the line of improvement, and point with satisfaction to the fact that, through recent large additions to factory facilities, it now ranks second among the world's manufacturers of incandescent lamps. Views of several of the company's lamps are here presented.



BUCKEYE LAMPS.

As is well known, this company has a specialty in filament which is produced in its entirety from its own laboratories, and is unexcelled in efficiency and life.

The company or any of its distributing agencies will be pleased to mail a copy of this catalogue on application. It is worthy of a place in every electrical company's collection.



Loop Filament. Standard, Coiled Filament. Special Decorative.

BUCKEYE LAMPS.

## Locomotive Engineers Must Acquire Electrical Knowledge.

The Traveling Engineers' association is composed of foremen of road engines from the various large railroad concerns. One of the duties of these men is to instruct in the use and care of locomotives, and on the handling and application of brakes and other appliances. At the recent annual meeting the president said:

There is some discussion among the men in the operating departments of railroads in regard to the use of electricity as the future motive power, but it does not seem likely that many regular trains will be run by it during the coming year except on suburban passenger railways. The success of the large motor used by the B. & O. for handling heavy trains through the Baltimore tunnel shows that these motors can be made to do the heaviest kind of work, while other tests have demonstrated the speed of passenger motors. Such being the state of development, we may find it necessary before long to begin to acquire a detailed knowledge of the operating of electric motors.

# CORRESPONDENCE.

## New York Notes.

NEW YORK, September 21.—It is admitted that this city is far behind other large municipalities in its electrical signal system for police service, but it appears that the new board is endeavoring to improve the present facilities. Police Commissioner Andrews, during a recent visit to Boston, investigated the system in use in that city, and was so much pleased with it that he made arrangements to have a working model tried at the West Thirtieth street station. The machinery was placed in position during the week, the local or station house end of the system in a small room in the station, and a box for outside tests at the corner of Sixth avenue and Thirty-first street. A signal box similar to those which, if the system is adopted, will be placed at every street corner, had been placed on the wall, 30 feet from the receiving station, and this was used to show the serviceability of the telephone part of the system. The iron box, which is two feet long by 1½ feet wide, contains a hook in the center and a telephone. The policeman on post wishing to talk to the sergeant at the station opens the door of the box, pulls down the hook, and the sergeant receiving the station number responds and uses the telephone. If the policeman wants the patrol wagon he moves a needle on a dial in the box until it points to "Wag," and pulls the hook. The call goes both to the station and the stable in West Thirty-first street.

Two keys unlock the box, but only one will work for the citizen. These keys will be given to any respectable citizen, and when he requires the services of a policeman he inserts his key and turns it and the call is registered automatically. His key remains locked in the door until released by a policeman. Commissioner Andrews said: "I am well pleased with the system. Other systems will, however, be tried in other precincts before a decision is made. I have received applications from several companies who wish to compete. The Board of Police Commissioners has asked for $250,000 to equip the department with a proper system, and I believe that sum will furnish half the police precincts with the necessary paraphernalia."

The statistics of the police telegraphs of New York city are interesting. The number of messages sent over the wires of the Police Department amounts to more than 1,000 a day. Last year the exact number was 378,388. The year before it was less by only 4,000. This branch of the Police Department is one of the oldest of the bureaus, and it has been much improved during the year through the underground service of the subways. Of the messages sent last year 20,580 were calls for ambulances, 10,541 were alarms of fire, 7,245 were announcements to the Department of Public Works of obstructions in some precincts. Nearly 5,000 related to accidents on the streets, and nearly 4,000 were notifications of sickness; 4,312 telegraphic messages sent over the police wires related to the business of the coroner's office, 3,400 to the Society for the Prevention of Cruelty to Children, and 1,030 to the discovery of property for which owners were sought. The maintenance of the police telegraph system costs in a year a considerable sum. The superintendent of telegraphs gets $3,000. His first assistant gets $2,000, and there are seven operators who receive $1,500 a year each. The sum of $500,000 was appropriated to the police telegraph system this year, and $35,000 to the work of placing telegraph and telephone cables under ground in 1895. These items are exclusive of cost of materials needed, which foot up $2,800 a year, besides which there are three linemen and one battery man in charge of the police wires.

In connection with the recent international yachting contest the following interesting item will be a relief to those who have been bored by the "official correspondence." A Boston correspondent writing September 9th, says: "The English cable steamer Minia arrived in the harbor this morning. The Minia was passed at 9 A. M. yesterday about 300 miles east of Boston by the Cunarder Catalonia. The news of the Catalonia's passing was cabled in to shore from the Minia. Several years ago the Minia cabled in the passing of the Pavonia. The Minia was at work splicing the Duxbury and St. Pierre-Miquelon cable when the Catalonia passed. The Cunarder went by just too soon to receive the news of the yacht race. The cable had already been grappled by the Minia and was only a few fathoms from the surface. Five minutes later the news of the race was known on the Minia."

The road of the Suburban Traction company will be sold at auction at Orange on October 14th, to satisfy a mortgage of $1,500,000 held by the American Loan & Trust com-

pany of Boston, on which bonds were issued. The proceeds of this sale will be subject to all of Receiver Whittlesey's certificates and to the underlying mortgage of $60,000 held by the Orange National Bank. The sale, it is said, will wipe out the claims of those who were injured in the Eagle Rock accident of last year.

Interesting experiments on a system of signaling from ships by electric lights have been tried at the Brooklyn navy yard. The principle of the invention is that of a monogram, inasmuch as by the use of a frame whose dimensions may be regulated at the will of the shipmaster, every letter of the alphabet may be produced on a plane by means of incandescent electric lights, one letter after another. The frame is divided into 20 sections. On each of these sections is a row of electric lamps. Each section of the monogram is connected on a separate circuit. By a combination of the various circuits all the letters of the alphabet may be formed. The conductors are carried in a cable to a machine resembling a typewriter, which may be located any distance away from the monogram, so that the operator may be entirely free from any disturbing influence and may be fully protected from storm. The keyboard of the signaling machine is that of a regulation board on the standard typewriters. Practically the only difference is that each key is in reality a switch and the circuits may be cut in or out. A working model has been built and has given some very satisfactory results in the Brooklyn navy yard. Some time ago a committee of naval officers was appointed by Secretary Herbert and the tests have been watched with a great deal of curiosity by many persons interested in maritime affairs. The model in the navy yard is three feet six inches square, but there is no limit to the dimensions which may be given to the frame. The size of the letters is, of course in accordance with the extent of the frame. For all practical purposes, however, the navy yard frame is as large as will be necessary in actual service. It is declared that letters 3½ feet long may be clearly seen at sea for a distance of 10 miles. The frame now being tested has lights of 16 candle power. W. F. O.

## Buffalo and Niagara Falls.

BUFFALO, September 20.—The joint power committee of the Common Council has discussed the franchise which will be offered to the Niagara Falls Power company, and has made amendments to accord with the wishes of the company and the advice of the advisory committee. There was not the slightest hitch in the proceedings. The franchise as it now stands is so framed as to meet all the objections on the part of the Power company, and there is a feeling of satisfaction in the minds of the committee at having at last apparently concluded their labors.

No time was lost in getting to business, and the letter of Secretary Rankine, of the Power company, refusing to accept the franchise in its previous form (WESTERN ELECTRICIAN, September 14th) was taken up and read by sections. The first section of the letter stated the objections of the Power company to the second clause of the proposed franchise. This is the section that required the company accepting the franchise to provide accommodations on its poles and in its conduits for two competing companies, as well as for the city's wires. The company objected to this as being too much to ask, and signified it willingness to provide space for one additional company, provided a time limit within which the second company was to avail itself of the privilege was fixed, and the second company be required to pay a proportionate part of the cost of construction and maintaining the conduits, with interest. The advisory committee's recommendation in regard to this matter (WESTERN ELECTRICIAN, September 21st) was then read. This was in effect that the request was a reasonable one and had better be granted. A councilman raised the point that the city should be allowed the free use of so much of the additional space in the conduits as might be required for municipal electric light wires and wires for carrying heat to schoolhouses, etc. Chairman Wilcox of the advisory committee thought the point well taken, and it was incorporated in the section by unanimous vote. On motion of Councilman Hanrahan the section was amended to read, "one other company," instead of two, and Councilman Mahar, acting as a substitute for Councilman Ash, moved that the term of 10 years be fixed as the time within which any second company must avail itself of the privilege of using the original conduits, which was also carried. The amendment requiring the second company to pay a proportionate part of the cost of the construction and maintenance of conduits and pole lines was also adopted, and the attention of the committee was turned to the second of the Power company's objections.

This was the sixth clause of the old franchise, which gave the Board of Public Works power to order any and all wires underground at any time. The company wanted a time limit here, also, within which it might be required to bury its wires. Councilman Mahar moved that in case of such changes being ordered, the company should be allowed six months within which to begin the work, and be required to finish it within a year. This was carried without comment and the section adopted as amended.

The third of the Power company's objections was the 5 per cent. tax on the gross receipts from the power sold in Buffalo. The company did not object to the tax in itself, but thought it should apply only on the second and succeeding blocks of 10,000 horse power, or else be remitted entirely for the first five years. The advisory committee had reported that both these plans had merit, and there was some discussion as to which was the better one. Alderman Durr thought that if the first 10,000 horse power was not taxed the company might be content with selling that amount, as might other competing companies operating under similar franchises, in which case the city would get nothing. Mr. Wilcox thought the point was well taken, as did Alderman Boeckel, and on motion of Councilman Klinck the ninth section of the franchise was amended to read that no tax was to be imposed on the company's receipts for five years after it began the actual work of delivering power to consumers, after which the tax is to be 5 per cent. on the gross receipts. Section 12, which also relates to the tax, was amended to correspond with section nine.

The fourth objection of the company was thought to be the most difficult one to reach an agreement about. Section 11 of the old franchise limited the life of the grant to 25 years. This, the representatives of the company had repeatedly informed the committee, was extremely objectionable, as the company's bonds have yet 36 years to run, and it was unwilling to accept a grant for any shorter period, as they claim it would be impossible to float the bonds in that case. The advisory committee made two suggestions in regard to this difficulty: "Either," they said, "the grant should be made for 36 years, with the provision for a readjustment of the amount of compensation to the city at a period midway in the term, or a franchise for 18 years, with the privilege of renewal on the same or more favorable terms should be granted." Chairman Wilcox supplemented the report of the advisory committee by an explanation of his views in the matter. He thought 36 years altogether too long for a flat agreement to be made. It might be unjust to both parties. The matter of compensation as fixed at present was largely a matter of guesswork at best, and if it were to be made permanent for so long a time it might prove to be of the greatest injustice either to the company or the city. He would favor a franchise for 20 years, with the privilege of two renewals for a similar term each, and in this way would give the company more than it asked, while amply guarding all concerned. It would appear very likely that before the Power company got through with its financeering it would need a 60-year franchise in order to float its bonds. Councilman Klinck objected on general principles to giving the company any more than it asked for. He thought that a franchise for 18 or 20 years with one privilege of renewal would be sufficient. Alderman Durr agreed with him, and there was some little discussion of the matter, all, however, being practically agreed that it was necessary to provide in some way for giving the company as long a grant as it wanted. Councilman Hanrahan pointed out that it would really not be giving the company any more to word the grant so that its life should be 36 years, with a provision for readjustment of its terms in relation to compensation to the city at the end of 18 years, while it would be much better to the company as being almost what it had demanded—a flat franchise for 36 years. He did not see wherein it could make any objection to such a phraseology, while it would object to an 18 year grant, as it had to one for 25 years. Mr. Wilcox concurred in Councilman Hanrahan's views, and a little explanation sufficed to demonstrate to the other members of the committee that there was no harm in wording the franchise in that way. The amendment was unanimously concurred in.

The company's fifth and last objection was to the phraseology of the fourteenth clause of the grant, which, it claims, gave the Board of Public Works and Common Council the right to annul the grant for alleged violation of the terms of the franchise. The advisory committee had not been able very clearly to understand the objection as expressed in Mr. Rankine's letter, but made the suggestion that it could be so worded as to allow the annulment of the grant only on proof of willful violation by the company of its franchise. This would not jeopard the city's interests and would wipe out the objection as nearly as could be ascertained. The amendment suggested was moved by Councilman Hanrahan and unanimously adopted, and so ended the latest revision of the much discussed and frequently revised franchise.

A sigh of relief went up from the members of the committee when his final objection was met and successfully vanquished. The balance of the proceedings consisted in referring the amendments to the corporation counsel to be added properly to the grant, with instructions to forward a copy of the amended document to the various interested parties. The committee then adjourned subject to the call of the chair.

"I see no reason," said Chairman Ansley Wilcox of the advisory committee to a reporter after the meeting, "where there now should be any further delay on the part of the company accepting the grant. We have certainly given them everything they asked for, while at the same time protecting the rights of the city. The franchise as it now stands appears to me to be as nearly perfect as a document of this kind can well be, with the possible exception of some slight change in the phraseology, which Mr. Rankine suggested might be desirable, but will not affect the sense of the grant at all. I am glad that the committee has come around to the views of the advisory committee and hope that there will be no further trouble whatever. I do not think there will be any." F. C. P.

## Washington, D. C.

WASHINGTON, September 20.—The Potomac Electric Light & Power company of Georgetown changed hands last week, and hereafter the plant will be run by O. T. Crosby, Charles A. Lieb, and J. H. Miller, who virtually represent the Georgetown & Tennalleytown Electric Railway company The price paid for plant is not known. The new owners have assumed charge and removed the office of the concern from 1323 Thirty-second street to the power house of the Georgetown & Tennalleytown road. The electric light company was incorporated several years ago by a number of local people, with the object of supplying the West End with light. The plant is located at Plimmetts Run on the Virginia side of the Potomac, opposite chain bridge, a line of wires conveying the current into Georgetown. The company, at its own expense, erected 30 arc lights on the canal road, extending from the aqueduct to the chain bridges, and operated the same free of expense to the District. Some trouble arose in the company, with the result that the plant was sold at auction, and bought in at a low figure by a New York firm, which continued to run it, holding on more to sell it at a favorable opportunity than for realizing profit. The outside capitalists were anxious to realize the money they had advanced to the concern when it was first started. The old general manager of the company, J. O'Donnell, is not serving in that capacity under the new management, but has been succeeded by H. T. Purdy, who at present is superintendent of the Georgetown & Tennalleytown road.

Consul Thomas O'Hara at San Juan del Norte, Nicaragua, advises the State Department that the telegraph line between Acoyapa and Rama has been completed. The consul further states that on the proposed telegraph line from Rama to Bluefields, the lowest bid is $24,700, Nicaragua currency, or about $12,700 in United States currency. It may be possible, he adds, that some of our American constructors might find it to their advantage to correspond with the government officials at Managua regarding the Rama-Bluefields line. In his communication Consul O'Hara states that at a recent municipal council of Bluefields, Captain John N. Sewell, late of New Orleans, La., but now a resident of Bluefields, submitted a proposition to supply the town with electric light, and that the proposition will probably be accepted. He suggests that American dealers in supplies might find it to their advantage to correspond with Captain Sewell.

Labor Day was observed in Washington by a parade that in its general appearance was most creditable to the city. The electrical workers had a dynamo on wheels, and a number of them carried small batteries operating electric bells, which they kept ringing merrily. A fine display was made by the Progressive Street Railway union. Its float consisted of a street car mounted on a wagon. It bore an inscription reading "In Use Thirty Years Ago," and another, "Ninth Street Up To Date." John C. Skillman served as driver for the outfit, and Conductors A. T. Stewart and Richard Rose were in charge of the car. On the top of the car was a miniature electric street railway in active operation, the design of A. T. Stewart. The diminutive mascot, "Snowball," was dressed in the regulation uniform of a street car man. The street car decorations were furnished by Needfeldt & Johns.

The people of Falls Church, Va., are greatly disturbed over the announcement that the construction of the proposed electric railroad to that place has been stopped on account of the lack of funds. Everything in connection with securing a right of way had been provided, and the people living at Falls Church felt satisfied that the project would be a success, although it is claimed that they have not contributed very liberally to the stock, the amount being $50,000.

The survey of the entire route of the Washington, Sandy Spring and Baltimore railroad has been completed, and the routes of the various divisions of the Baltimore electric line have been decided upon as follows: From Frederick the road will pass through Limekiln, Buckeyestown, Ur-

bana, Hyattstown, Damascus, Etchison, Latinsville, Olney and Sandy Spring to Ashton, where the Frederick division will end and the Baltimore, Washington and Chesapeake division will begin. The Baltimore division will pass through Highlands, Clarksville, Doughoregan and Columbia to Ellicott City, and there connection will be made with one or all of the trolley lines in course of construction between that place and Baltimore. The Washington division from Ashton will pass through Ednor, Colesville, White Oaks, Rapley's, McCulloch, Rockdale, Lenox Park and Takoma Park, where connection will be made with the Seventh street trolley line to Florida avenue in this city. The Chesapeake division will pass through Ednor to Laurel Junction, and thence through Stabler, Spencerville, Burtonsville and Scotchtown to Laurel, and through Prince George's county to Upper Marlboro, where connection will be had with the Washington & Chesapeake Beach railway for Chesapeake Beach, upon the western shore of the bay. When the Washington & Chesapeake Beach road is completed the beach can be reached from this city in 35 minutes, Baltimore in 1¼ hours, and Frederick in about two hours. James Colegrove of this city is president of the company and Dr. Frank C. Drane of Baltimore general manager. Dr. Drane says that the new road when completed will for the first time afford to the residents of a beautiful, thickly settled and fertile agricultural district connection with Baltimore and this city, and will also give them connection with the Pennsylvania and Baltimore & Ohio roads at many junctions which could only heretofore be reached by tedious stage rides. Another feature of great value to the company, he says, will be the passenger traffic which must come because of the rapid suburban developments. It has been estimated that the road can be built at a cost not exceeding $25,000 a mile. This estimate includes the equipment of every kind, also sidings, bridges, stations, power houses, dams, water works, and hotels and excursion grounds contemplated by the company. The road between Washington and White Oaks and between Frederick and Buckeyestown will be double tracked, and the remainder single track with long sidings. Four power houses will be built along the line. W.

## PERSONAL.

H. T. Richards, who for several years was connected with the *Electrical Review*, has accepted a responsible position in the sales department of the Safety & Insulated Wire company of New York. With the push which Mr. Richards has always shown, it is reasonable to expect success in his new business relation.

Frank Judson Pope, son of Ralph W. Pope, has joined the staff of the New York *Evening Sun*. The young man was graduated by Columbia college, class of '95, and he is well fitted for his position, but it will require his best efforts to sustain the family reputation.

Thomas G. Grier of the firm of Grier Bros., western managers for the Bryant Electric company, has been dangerously ill with an acute attack of bilious-fever. His recovery was considered doubtful for some time, but his friends will be glad to learn that he is now out of danger.

## ELECTRIC LIGHTING.

The Parkersburg, W. Va., Electric Light & Power company's plant was badly damaged by fire and water recently, and narrowly escaped total destruction, the fire sweeping away almost the entire block in which the plant is located. The current was cut off for two days, but the necessary repairs have now been made.

## TRADE NEWS.

The Connecticut Telephone & Electric company of Meriden, Conn., is perfecting an instrument which is receiving the approval of many experts who have examined it.

The Ætna Electric company of Hartford, Conn., has recently extended its factory to take in another floor, and it is now installing the necessary apparatus to increase its production of incandescent lamps that it may take care of the increase in business.

The New England Switch company of Bridgeport, Conn., reports having recently received a line of new business through the West and Central states, which shows an increase over the previous months of this year. It is preparing to extend its business facilities.

The Hart & Hegeman Manufacturing company of Hartford, Conn., is working its factory to its full capacity, and if orders increase it will be obliged to add materially to the present manufacturing facilities. The trade in the West is showing an unusual increase during the last month.

The Perkins Electric Switch Manufacturing company of Hartford, Conn., has issued a circular descriptive of the arc lamps of Waterhouse, Gamble & Co., which it is exploiting. These lamps have been improved in many details since they were first introduced, and to-day their makers claim for them superiority in efficiency, economy and durability.

The revised catalogue and price list of J. E. Lonergan & Co., brass founders and finishers and manufacturers of patent sight-feed oilers and lubricators, pop safety, water relief and snifter valves, single-bell chime whistles, steam traps and other safety steam appliances, of No. 211 Race street, Philadelphia, illustrates the results of a long practical mechanical experience. The firm claims that in design, material and workmanship its goods are examples of absolute excellence.

The Electric Appliance company, Chicago, is ready with a very complete catalogue of the Upton arc lamp, showing a large line of plain and fancy lamps for regular series arc, direct current constant potential, and alternating constant potential circuits. The company claims to have what has long been looked for in the alternating arc lamp line, and that is a noiseless lamp.

The board of appeals of the United States Patent Office has just reversed the decision of the primary examiner and has granted the right to protection upon what is appropriately and conveniently termed "Flexible Mica" for insulation, recently introduced by the Mica Insulator company of 213 Water street, New York city. Edward P. Thompson, of New York appeared for appellant.

The Perkins Electric Switch company of Hartford, Conn., is at present rushed with orders for its various products. General Manager J. J. Gates reports that indications point to the largest trade the company has ever had in its business, and it is endeavoring to accumulate a stock from which it can fill orders promptly. A number of novelties are being perfected which will be offered to the trade later on.

Treasurer C. E. Newton of the Jewell Belting company of Hartford, Conn., has been having some practical tests made with the new Jewell pulley cement. He claims that after the most severe trials upon dynamo pulleys and in other cases where high speed is maintained it has given satisfaction; and the Jewell Belting company believes it has now got something which they can offer to the electrical trade with a guarantee of its efficiency. The company is sending sample packages of this cement to firms who desire to give it a trial.

The Pumpelly-Sorley Storage Battery company of Chicago has closed the following contracts during the last week: 240 200 ampere hour cells to the St. Joseph & Benton Harbor Electric Railway Light & Power company of St. Joseph, Mich., to be used as an auxiliary in conjunction with the railway plant, this being the first installation of storage batteries for electric railway purpose in the United States; 56 150 ampere hour cells to the Hotel Ashland, Chicago, to operate an electric elevator from 7 A. M. until 4 P. M., the cells to be charged from 4 P. M. to midnight by a rotary transformer from an alternating central station.

Secretary A. D. Newton of the Eddy Electric Manufacturing company of Windsor, Conn., informed a representative of the WESTERN ELECTRICIAN that contracts had recently been given for a large amount of new machinery necessitated by the rapid increase in the business during the last two months. Several departments of the factory have been working over time in order to keep up with orders for future delivery. This concern has always kept the high standard of its apparatus well known before the electrical trade, and during the depression of business it was favored with an unusual amount of good trade which is now showing its natural increase.

The Metropolitan Electric company, Chicago, was delayed in delivering its catalogue as promised, on the first of the month, on account of additional matter that has come up, which will increase the book to 700 pages. The Metropolitan incandescent lamp, handled exclusively by the Metropolitan Electric company of Chicago, has not been on the market two years, but it has an excellent reputation for long life and brilliant illumination at an economical cost. P. & B. tape, which is acknowledged by street railway companies as a standard article, is handled by the Metropolitan Electric company, which is the general western agent for the P. & B. tape, compound and varnish.

There could be no better indication of the return of good business prospects than the report from General Sales Agent R. B. Corey of New York that he is at present at work upon the second edition of his catalogue showing the various styles of alternating and direct current Bergmann arc lamps, the previous edition having become exhausted during the last few weeks. This catalogue will be ready for delivery soon. H. H. Harrison, who is connected with Mr. Corey, has recently returned from a trip through the South and reports a number of good orders and a large number of contracts for future delivery. There is no concern better known in the electrical trade, and as the short winter days are coming on, it will without doubt furnish its share of the necessary arc lamps.

The Electric Storage Battery company has closed a contract for a storage battery of chloride accumulators to be installed as an auxiliary to the electric lighting plant in the summer home of W. Luttgen, Linden, New Jersey; for a battery installation for the residence of John J. Dewey, Quecho, Vermont, and also a battery to be operated in connection with isolated lighting plant of Lewis Jones, Overbrook, Pennsylvania. It may be mentioned, too, that about a year ago the Stock Quotation Telegraph company of New York installed at 16 Broad street a battery of 100 chloride accumulators for use in operating its tickers. The improved service, the increased economy and the element of safety in always having a reserve supply of current, has led the company to install in its Baltimore office a battery plant of 120 chloride accumulators, which will be used to operate the tickers in that city.

## BUSINESS.

Huebel & Manger, Brooklyn, N. Y., report their trade from the West to be rapidly increasing. W. W. McChesney, Jr., their western salesman, has started on his fall trip to help keep up the good work.

The Walker Manufacturing company, through Kohler Brothers of Chicago, has sold to the St. Louis & Meramec River Railway company two 300 kilowatt generators, 10 double car equipments of 50 horse power each and 10 double car equipments of 30 horse power each.

H. W. Sumner, manufacturer of gas and gasoline engines at Covington, Ky., has issued a dainty little booklet showing the "Advantages of Gas and Gasoline Engines." A very clear and simple explanation of the operation of the gas engine is given. The advantages of the Sumner engine are claimed to be in the electrical igniter, the gasoline device, the governor, and the apparatus for easy starting.

The Mason Electric Equipment company, selling agent for the Fiberite company, manufacturer of the Medbery overhead material, is in receipt of a letter from the manager of one of the largest systems in this country, which reads as follows: "I cannot say too strongly that in my opinion, based upon the using of very large quantities of Medbery material, anyone who wants to put up a first-class line, and to be free from trouble with it afterward, would make a mistake if they used any other goods but yours, and you are at liberty to refer to us anyone who wishes to know more about your goods."

Eugene Munsell & Co. of New York believe in keeping themselves prominently before the trade. They have sent out a number of samples of stamped, solid sheet mica segments with the request that the recipients hang them up, and when they want anything in that line to send to Munsell & Co. Concerning electrical mica the firm says: "The demand for electrical mica has increased so rapidly that we have been compelled to enlarge our facilities. This we have done by adding a space of 2,600 square feet and putting in three new presses in addition to what we already had. This puts us in a position to fill all orders promptly for stamped, solid sheet mica segments, in both India and amber qualities."

The Cutter Electrical & Manufacturing company of Philadelphia has issued a pamphlet on "Automatic Magnetic Circuit Breakers," in which it describes the Harrington magnetic circuit breaker, designed on original lines and involving special features peculiar to this device. The statement is made that in all attempts in the direction of the protection of electric circuits, failure has always been due to the arcing at the switch, ultimately causing its breakdown. This magnetic circuit breaker is so constructed, it is claimed, that the arcing is transferred away from the circuit breaker to a favorably located fuse or shunt block which contains a light copper fuse in shunt to the main break of the circuit breaker. The fuse is considerably less in fusing capacity than the minimum current adjustment of the circuit breaker, advantage being taken of the very quality which condemns the use of fuses as a means of protection.

The Triumph Electric company of Cincinnati announces a largely increasing business during the last year. The company has recently placed four new multipolar generators in Chicago, and is at present installing two 65 kilowatt directly connected machines in one of the largest shoe manufactories in Cincinnati. The demand for this class of apparatus has been exceptionally heavy. Its multipolar elevator motor with new automatic controller has received immediate approval in the elevator business. The Atlanta exposition company has 12 machines of different sizes in use in the machinery department, besides an attractive exhibit in the electricity building, where E. F. Seixas takes care of the company's friends and acquaintances, and cheerfully explains the many advantages of the Triumph generators and motors to all who give him the least encouragement. The company is much pleased to be able to say that already the results of Mr. Seixas' work in connection with this exhibit are apparent in increased business from that section.

Manager J. M. Hill of the Chicago office of the Columbia Incandescent Lamp company of St. Louis was interviewed last week by a representative of the WESTERN ELECTRICIAN on the prospects for fall business in the incandescent lamp market. Mr. Hill spoke most encouragingly of the steady business increase which had been, and was still being, experienced by his company. He said: "A year ago the lowest priced incandescent lamp was the one that 'went,' but now purchasers have awakened to the value of a good lamp. Such points as maintenance of candle power, efficiency and uniformity, which a year or so ago were only appreciated by the electrical engineer, are now thoroughly understood by the laymen purchasing agents, and as a consequence one can now get a fair price for a good lamp." As one of the most convincing illustrations of this encouraging fact Mr. Hill stated that the business of the Columbia company's Chicago office for the first 20 days in September, '95, showed an increase of over 1,000 per cent. over that for the same time in September, '94. Mr. Hill has undoubtedly done most excellent work for his company, and he is looked upon as one of the most energetic lamp salesmen operating from Chicago. Mr. Hill deems that the secret of his success lies in the fact that his company has maintained the price of 20 cents for barrel lots and over, and now that purchasers have learned the value of a good lamp the Columbia company has not the slightest difficulty in making large sales at its very fair price.

The announcement that arrangements have been made with the Lake Shore & Michigan Southern railway for special cars and accommodations to the Montreal convention will interest street railway and electrical men in general. If a sufficient number of reservations be received the Lake Shore train will be run as a special exclusively for the delegates of the street railway convention. Under any circumstances, however, special cars will be kept for the street railway people. It is expected that almost all the western and central delegates will go by the Lake Shore, and those desiring to join the Lake Shore party, should write C. K. Wilbur, W. P. A., Lake Shore Depot building, Chicago. The Lake Shore has made arrangements to have a special passenger agent accompany the train all the way to look after the delegates and their ladies. The train will be made up at Chicago, passing through Toledo, Cleveland, Ashtabula, Erie, Dunkirk, Buffalo, Rochester and Syracuse. At Utica the train turns north for a daylight ride through the Adirondack mountains and will run into Montreal at about 2:30 P. M. the following day. It is entirely unnecessary to dwell

tages of going via the Lake Shore, as the daylight ride through the Adirondack mountains in itself would be sufficient to pay one to make the trip to Montreal even though there were no convention to be held at that point. It is not necessary to enlarge, either, upon the superb accommodations which the Lake Shore will place at the disposal of the party in the way of elegant dining cars, reading room, buffet, etc. As the convention has been set to open a day earlier than usual, commencing Tuesday morning, October 15th, it will be necessary to leave Chicago, Sunday morning at 10:30 o'clock arriving at Toledo at 4:45 P. M., Cleveland 7:35, Ashtabula 8:54, Erie 9:54, Dunkirk 10:01; Buffalo 12:10, Rochester 3 A. M. and Syracuse 5 A. M. Cars will run through to Montreal without change. Delegates desiring to leave on any other dates should take either the 3 P. M. train or the limited 5:30 P. M., arriving at Montreal at 10:15 the following evening. The special rate for the round trip is $24 on the certificate plan, and the sleeper $5 each way. It should be noted, too, that special cars will also be reserved for gentlemen accompanied by ladies.

The monocyclic system developed by the General Electric company is about to be used in Salt Lake City, the distribution being made on the three-wire secondary method from large transformers. Most of the lighting will be confined to a space covering about six blocks, and as the blocks in Salt Lake City are 800 feet square, the territory covered is somewhat large. A branch line will run from one corner of the district for about a mile along the best residential street, while another line will run out from another corner of the district for about 1,500 feet to the county and city building. These lines will be gradually extended over other parts of the residential district as soon as the demand for such an extension arrives. The station will be located on the railroad track 3,000 feet from the nearest side of the rectangular district of six blocks and 4 800 feet from the farthest side. The generating plant will consist of two 150 kilowatt 2,000 volt monocyclic alternators, belted directly to two Buckeye engines. As the large blocks are more or less open, the center space being occupied by stores, barns, etc., room is thus afforded for the pole lines for the secondary wires around the inside of the block. From these service wires will be run into the rear of the buildings. The plans contemplate the installation of two three-wire transformers to each block, one on each side of this interior court and the three-wire secondaries running around the court will be directly supplied from these transformers. As the number of lights in the block is increased the transformer equipment will be expanded. For lighting the residential districts from the branch lines the usual course of using small transformers will be followed, bunching them as far as possible. Motors are to be connected at once as required, the balance wire being introduced only for motor work. The monocyclic system was selected chiefly on account of the facilities it offers for the economical operation of motors, and the fact that it allows of a practical solution of the day load difficulty. The General Electric company has just secured a contract from the Carnegie Steel company for a 150 kilowatt monocyclic generator and the necessary station equipments. At the Edgar-Thompson steel works, owned by the Carnegie Steel company, where this equipment will be placed, two-phase apparatus has been heretofore used. The contract was secured on the merits of the monocyclic system for combined light and motor distribution with the greatest simplicity and highest efficiency.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

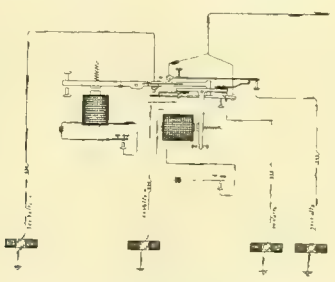
*Issued September 17, 1895.*

546,308. System for Controlling Railway Trains. Adolph L. De Leeuw, Springfield, O. Application filed January 25, 1894.

A series of stations are arranged at intervals in the railway track, each station consisting essentially of a moving part, and an intermittently moving mechanism for alternately locking and unlocking the moving part, an electric contracting device connected to the moving part, and electrically operative mechanism for moving the locking device, and an electrical connection in multiple arc from each of the contacting devices to the electrically operated mechanism of two or more stations arranged in opposite sides thereof.

546,324. Dynamo Telegraphy. Albert S. Harris, Minneapolis, Minn. Application filed February 13, 1895.

The cut shows an arrangement including a transmitting instrument embodying two sets of contact points each set being independently controlled by a lever two sources of current of like potential but of opposite polarity connected to one set of contacts, and two other sources of current of different potential and opposite polarity connected to the second set of contacts.



NO. 546,324.

546,348. Electrolytic Apparatus. William A. Rosenbaum, Montclair, N. J. Application filed December 20, 1894.

In apparatus for the electrolytic production of hydrates of alkaline metals a tank or cell is provided with a compartment containing a layer of mercury which is adapted to receive a charge or deposit of the alkaline metal, an electrolyte in the compartment capable of oxidizing the alkaline metal and dissolving the oxide so produced, and an anode and cathode immersed in the electrolyte and separate and distinct from the mercury.

546,353. Electrolytic Apparatus. Alf Sinding-Larsen, Christiania, Norway. Application filed July 9, 1894.

An electrolytic apparatus, comprising a decomposing cell, a suitable anode therein, a solution cell, a passage leading from one cell into the other, a mercury cathode adapted to form a seal for the passage, and a revoluble cylindrical amalgam coated conveyer within the solution cell, adapted to take up the electrolytically formed amalgam and convey the same from the decomposing cell into the solution cell without breaking the seal.

546,357. Telephone. Ira D. Smith, Pittsburg, Pa. Application filed May 3, 1895.

In a telephone, a spring controlled-carrying bar for the receiver is pivotally supported between its outer and inner ends; there are also a toothed disk in mesh with a pinion on the shaft of the generator armature, and a pitman attached to the inner end of the carrying bar and to the toothed disk.

546,383. Insulator. Gottleib Gerstenlauer, Williamsport, Pa. Application filed March 27, 1895.

An insulator for electric wires is described, comprising a body of non-conducting material, a perforation for the reception of the line wire, and an open slot communicating with the perforation, in combination with a grooved and tapering pin or cylindrical plug adapted to enter the perforation and to receive and bind the wire in fixed relation to the insulator.

546,388. Electric Arc Lamp. Samuel P. Parmly, Chicago, Ill. Application filed October 26, 1891.

Two electrodes constituting the opposite terminals of the lamp, each consisting of two or more pencils in electrical connection along longitudinal edges, and feeding mechanism therefor.

546,389. Underground Conduit for Electric Railways. Herluf A. F. Petersen, Milwaukee, Wis. Application filed March 19, 1894.

This invention comprises a plurality of converging underground conduits for electric conductors, and suitable means for establishing continuous communication between a desired pair of the ends of the converging conduits, suitable means for closing the ends of the conduits which are not in communication, and suitable tubular connections communicating with the conduits at both sides of the junction thereof, and arranged to permit an air circulation past the junction from one conduit to another.

546,403. Arc Lamp Mechanism. Karl A. Lantau and Carl J. Anderson, Chicago, Ill. Application filed February 28, 1895.

Claim 1 follows: The combination with the block of insulating material secured to the frame of the lamp, of the plate mounted upon the front of said block, the end of said plate serving as one terminal of the cut-out, the plate mounted upon the rear of said block and provided with a horizontal extension bent plate, mounted by one end upon the end of extension and resting by its free end in contact with the end of plate to constitute the second terminal of the cut-out, and the armature mounted upon the under side of plate and insulated therefrom.

546,407. Trolley Wire Bracket. Leroy S Pfouts, Canton, O. Application filed October 20, 1894.

The cut shows an arched arm, having springs attached to the side portions, and the inner ends connected to a trolley wire clamp.

546,417. Thermo-electric Generator. Harry B. Cox, Hartford, Conn. Application filed October 4, 1894.

The surface to be heated is comprised within and forms a part of an insulated fluid circuit or conduit; means to heat the fluid in the conduit, and a propeller in the conduit for circulating the fluid therein are provided.

546,442. Electric Motor. Frank H. Williams, Greene, N. Y. Application filed March 11, 1895.

There is in combination with the motor magnets and the armature a circuit-breaker, consisting of an inferior supplementary magnet, having its helix connected with the core and with the motor magnets, and an electric contact-finger carried to and from the core of the supplementary magnet by the aforesaid armature, as set forth.

546,471. Conductor for Terminals of Electric Circuits. Jules E. Neher, Pittsburg, Pa. Application filed July 30, 1894.

In a connector for the terminals of an electric circuit a yielding, resilient, insulating support is employed for one of the terminals, and an unyielding, insulating support for the opposing terminal, and means for clamping the parts together.

546,475. Fuse Block. Henry N. Potter, Allegheny, Pa. Application filed October 17, 1894.

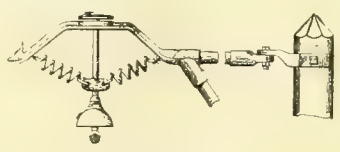
This device comprises a fuse, an adjacent heat-generating conductor electrically connected in series therewith, interposed non-conducting material and an insulating shell or casing.

546,476. Electric Converter. Charles F. Scott, Pittsburg, Pa. Application filed January 12, 1895.

A secondary coil presenting a plurality of conducting paths leading to single-work circuit, and having considerable breadth in a single plane, as nearly as possible parallel to the leakage lines of the converter, is described.

546,483. Electro-depositing Apparatus. Henry L. Bridgman, Blue Island, Ill. Application filed December 22, 1894.

An anode device for electro-depositing apparatus is described, comprising a basket formed with end-plates supporting pockets in vertical series for holding the anode material, in combination with a stirring implement extending through the vertical series of pockets.



NO. 546,407.

546,494. Insulating Railroad Joints for Electrical Signals. Thomas O'Brien, Jr., Philadelphia, Pa. Application filed July 18, 1895.

A wooden stringer on which the insulated ends of rails are supported, longitudinally extending wooden blocks beside the rails, and metallic chairs secured to the blocks and separated from each other, the bases of the chairs being also separated and adapted to be spiked to wooden ties.

546,534. Electric Arc Lamp. Daniel Higham, Boston, Mass. Application filed June 4, 1895.

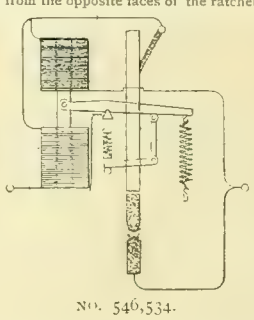
A suitable feeding mechanism is employed with a carbon rod and clutch, in combination with a spring or elastic stop for the clutch acting to lock the clutch with the rod and to oppose the magnetic action of the series windings of the lamp when the arc is being struck, but free from action upon the clutch and opposition to the series windings when the lamp is normally working

546,546. Electric Railway. Harry M. Montgomery, New York, N. Y. Application filed June 14, 1892.

In an electrical railway there is the combination with a continuous supply conductor, of a sectional working conductor, and an intermediate auxiliary conductor formed of a continuous series of similar magnetic parts interlinked and in electrical contact with each other for connecting the supply conductor with the sections of the working conductor.

546,553. Electric Calculator. William C. Porter, Arlington, Minn. Application filed December 1, 1894.

The first claim follows: In an electric calculator, the combination of a series of dials, each representing a different denomination and having numbers upon their faces corresponding to the places in each denomination, electro-magnets for each dial provided with armature, each adapted by the action of the magnet to move an arm with a pawl thereon, ratchet wheels adapted to be engaged by such pawls, and thereby rotated to the right or left together with its connected dial, each time an electric current passes through the magnet; means to swing the arms and pawls back when the electric current is broken, studs projecting from the opposite faces of the ratchet wheels, a post



NO. 546,534.

carried by each of said arms, and adapted to swing therewith, said studs being so disposed and said post so adapted as to come in contact with one of said studs only when a number is to be added to or taken from the next higher denomination; means for connecting said studs with one pole of an electric battery, and means for connecting said posts with the other pole of the battery in such manner that when a post and stud are in contact with each other an electric circuit is closed through the corresponding magnet of the next higher order, and other means for making and breaking an electric current through the respective magnets of each denomination.

546,560. Electric Locomotive. Sidney H. Short, Cleveland, O. Application filed April 23, 1894.

An electric motor is journaled on the driving axle, gearing connecting the armature shaft and axle, a cross-bar is yieldingly mounted on the track frame, and there is a laterally swinging link for connecting one side of the motor casing and the cross-bar.

546,579. Insulated Electric Conductor. Franz Clouth, Cologne, Germany. Application filed June 26, 1895.

The arrangement comprises an electrical conducting wire or conductor, a covering layer of caoutchouc surrounding the conductor or wire, and a layer of guttapercha surrounding and inclosing the caoutchouc.

546,582. Electrical Piano. George H. Davis, New York, N. Y. Application filed June 17, 1895.

Means are provided for electrically operating the keys, a rotary note-sheet holder hinged at one end to the piano is adapted to be swung down out of position, and catches secured to the piano and adapted to support the sheet holder are in operative position.

546,585. Insulator. William Dibb and Albert Vickers, Syracuse, N. Y. Application filed March 12, 1895.

An insulator is provided with a cavity in its upper end; there are similar opposite slots in the wall thereof to receive the line wire, and a plug to kink the wire.

546,613. Electric Fusible Cut-out. Duane N. Gleason, Brooklyn, N. Y. Application filed July 19, 1892.

In an electric cut-out there is the combination with an insulating base, having an opening through it of U-shaped contact pieces forming two arms, connecting screws on one side of the base, and connecting nuts on the opposite side for attaching the line conductor and fusible conductor respectively, the fusible conductor extending through and across the opening.

546,625. Electric Arc Lamp. Henry A. Seymour, Washington, D. C. Application filed July 20, 1895.

There are an arc-inclosing globe and a cover seated directly upon the upper and open end of the globe, and adapted to move laterally in any direction, the cover being provided with an opening in which the feeding carbon snugly fits, and through which it feeds.

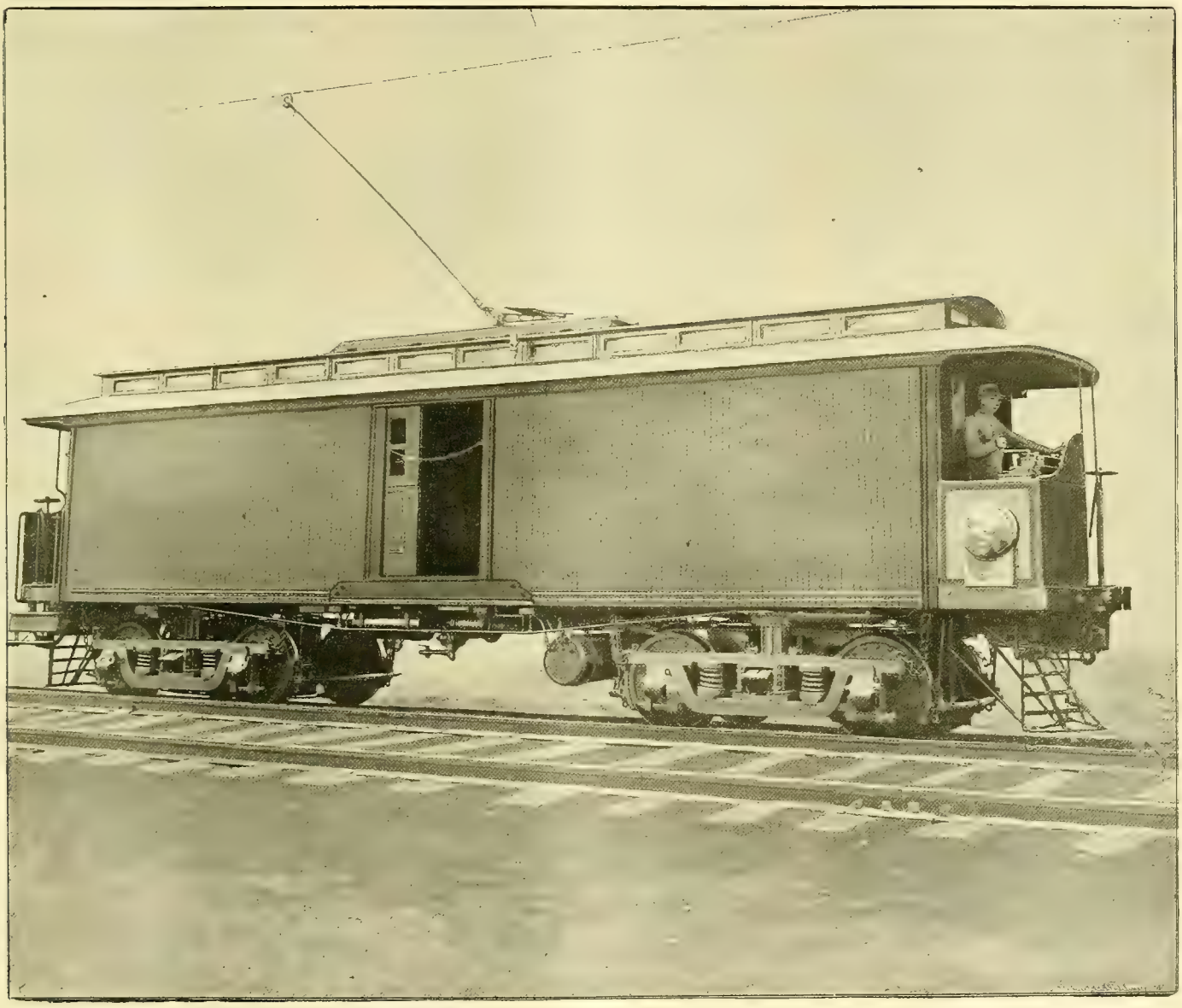
Western Electrician.

EVERY SATURDAY.

Vol. XVII. CHICAGO, OCTOBER 5, 1895. No. 14

## Combined Motor and Baggage Car for Suburban Roads.

Experience gained during the last season has demonstrated the fact that upon suburban roads a combined motor and baggage or freight car can be employed with advantage. Several of these cars have been in use for two or three months upon several roads extending from large metropolitan centers into surrounding towns partaking of the character of summer resorts. One of these cars, which may be considered typical of the idea, is herewith illustrated.



COMBINED MOTOR AND BAGGAGE CAR FOR SUBURBAN ROADS.

It is a closed motor car, substantially constructed, 42 feet long over all and when fully equipped weighs 30 tons. In appearance it resembles an ordinary baggage car for steam road service, and with the exception of the little space at either end occupied by the motorman in charge, the entire car can be utilized for carrying freight or baggage. The officers of the New York, New Haven & Hartford road, upon whose lines extensive experiments with these cars were made last summer, report very favorably upon the idea and other railroads are now preparing to follow this example in similar work. Of those used last summer two had two motors on one truck, while two others had four motors, two on each truck. The motors used are especially designed for heavy work. They are similar to those in use on the Metropolitan elevated rail y in Chicago. They are watertight and fireproof. The drawbar pull of the two-motor motor cars is 4,000 pounds, that of the four-motor motor cars 8,000 pounds, the motors being 100 horse power each, or 200 pounds horizontal drawbar pull through a 33-inch wheel.

The current is brought from the trolley wires by means of a trolley provided with a wheel having an extra deep channel, to the motors through a series parallel controller which, in this case, is set up on the right-hand side of the platform. The controller should be somewhat larger than the ordinary device for street railway service. It embraces the magnetic blowout principle, and the resistances are suspended beneath the car. Two controllers are employed on each car. Immediately to the left of the controller is the air-brake handle. The compressed air for the brake and whistle is furnished by an oscillating cylinder air compressor operated by an electric motor, which is controlled by a special automatic rheostat which regulates the action of the motor in accordance with the pressure in the tanks. A magnetic cutout is also provided for the air compressor motor. The air pump is set just within the door. Behind the motorman and just under the hood is the car cutout, which in this case is an automatic circuit breaker.

Two 15-inch gongs are furnished to each car and are rung by the foot, and on one side near the center of the car on the roof is a chime whistle operated by compressed air. The cars are lighted by six incandescent lamps. Each motor car has a small pilot or cow-catcher placed beneath each platform.

During the last summer on the Nantasket branch where these cars were used it was decided that the trains were to be run as accommodation or express, the express trains consisting of a baggage-motor car with open trailers, the accommodation facilities being furnished by single open motor cars. The traction weight of the baggage cars is increased by the baggage they carry. The trains run with the baggage car at the head, and at Pemberton station the motor car uncouples, switches and runs back to the head of the train, the motorman changing platforms the same as in the case of the Chicago Metropolitan L road terminals.

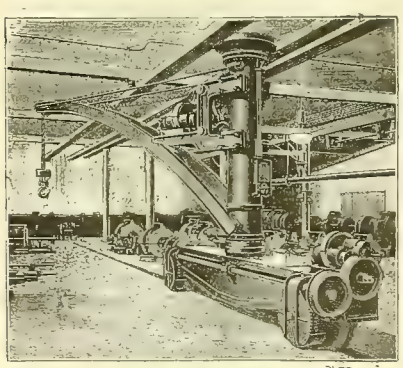
The success which has accompanied these experiments and the improvements suggested by the tests have opened up many possibilities to steam road managers as well as street railway men. Experience has already shown how the electric roads can cut into the short distance travel of the steam railways, and it is not difficult to believe that they may make considerable inroads into the short-distance freight traffic. Of course the vast bulk of railway freight traffic could not be affected by this short-haul competition, but still the possibilities are of interest to contracting agents and managers.

Other applications might be suggested, too, which will eventually take advantage of the experience now being gained. The Pennsylvania House of Representatives has by vote of 121 to 18 passed a bill, which it is believed will find much favor, giving street railways the right to carry freight, and an extensive parcel delivery business is expected to be built up by the lines in Philadelphia and elsewhere. The Lehigh Valley road is credited with the intention to equip all of its smaller branches as trolley roads, to carry both freight and passengers. The supervisors of Vermillion county, Illinois, recently granted the free use of the public highways for a period of 20 years to a company to build an electric freight and passenger road from Danville north for 30 miles parallel to the Chicago & Eastern Illinois railway, upon condition that the maximum passenger rate should be 1½ cents per mile. A company is being organized to build an electric line 45 miles long from Port Huron, Mich., to be laid with heavy T-rails and to be equipped with standard passenger cars, seated like steam railway coaches, and with standard type freight cars. The difference in cost in the construction of electric roads and steam roads is enough to warrant the statement that the new service can be provided at much lower expense than was possible in the old steam practice.

## Electrical Energy in the Henrion Works at Nancy, France.

This installation comprises one horizontal condensing engine of 150 horse power, having a speed of 75 revolutions per minute, driving a dynamo of 105 kilowatts capacity at 110 volts, running at 380 revolutions. The two regulators, engine and dynamo are so combined that the voltage remains constant through abrupt changes between 100 watts and 120 kilowatts. From the dynamo room the mains lead which furnish the shops and distribute the electrical energy. These, aside from the lighting circuits, which comprise both arc and incandescent systems, furnish a variety of machines, as for instance, a centrifugal pump, actuated by a 15 ampere motor. This pump takes the condensing water, cools it and returns it for use over and over again; and in the same room motors from 71.5 to 24.2 kilowatts for testing dynamos are found. There is also a motor of 60 kilowatts for running various machinery, and one of 6.6 kilowatts actuating a band saw, while sundry others move circular saws, band saws, and ventilators of various dimensions. There are also electrical furnaces for heating iron plates, soldering irons, and stoves for heating purposes, not to mention electric clocks.

It is not necessary to enumerate all the electrical appliances in use, of which but a small number have been mentioned. But what is deemed particularly interesting, according to *La Nature*, is the huge electric crane represented in the cut, having a capacity of six tons. This is found in the machine shop, and has a horizontal travel of 80 meters. It has an arm of five meters radius, which moves on a horizontal circle, so that its extreme sweep is 10 meters. Two motors con-



ELECTRICAL ENERGY IN THE HENRION WORKS AT NANCY, FRANCE.—GENERAL VIEW OF THE ELECTRIC CRANE.

trol respectively the lifting and transmission movements. The motor seen back of the center column has a mean power of two kilowatts, turns at a rate of 600 revolutions, and moves two intermediate gears not shown in the illustration. The last wheel of the combination actuates a toothed wheel mounted on a horizontal arm extending the length of the crane. This arm carries two endless screws, which move either forward or backward at a rate of 80 revolutions per minute, and two guides are seen along which the crane moves. The electrical energy is brought to the machine by bare wires on insulators, and the contracts are sliding ones. A second motor raises and lowers the hook tackle, has a power of 3.3 kilowatts, and acts directly upon gears and an endless screw upon a drum-wheel. The speed of the arm carrying the weight is graduated by a rheostat and a reversing switch. The lifting motor is regulated by a special rheostat on the column. The motor, when the weight is to be let down, acts as a generator when too much speed is attained, and thus becomes a break to check the descent. With no load, at 110 volts, the traveling motor absorbs at starting 20 amperes, and a mean of 10 amperes for a carrying speed of 17 meters per minute. Under similar conditions, the lifting motor consumes 12 amperes in starting and afterward uses 3.5 amperes. The chain decends at the rate of 2.16 meters per minute. With a load of 2,190 kilogrammes the mean intensity absorbed by the carrying motor is 10 amperes if the arm is in the same plane as the body of the crane, and 18 amperes if the arm is perpendicular to the body of the crane. With the same load the lifting motor consumes 27 amperes and moves the chain with a speed of 1.6 meters per minute.

## From the Coal Pile to the Meter.[1]

By James Milne.

We see so many curves these days showing the high efficiency of this and the very high efficiency of that, and so on, that we are apt to think there is little room for improvement. My intention is therefore to trace from the coal pile to the meter on the consumer's premises, and endeavor to show by means of diagrams, calculated from different sources, the condition of affairs in light and power plants and to see if there is not something that could be improved on.

Fig. 1 illustrates at a glance the following: First, the amount of coal required to keep up the pressure at the boilers without delivering any to the main steam pipe. It will be seen that for 16 hours about 40 pounds are consumed and for eight hours it takes 100 pounds per hour; second, the amount of coal required to keep the pressure up when steam is turned on the main pipe, which is equal to 210 pounds hourly; third, the amount of coal required to keep the steam pressure up for running the average friction load in summer. In this load I have included the power required to run the generators and charge the fields, but not supplying any current to the external circuit. Beginning at 11 P. M. we find the average friction load takes 310 pounds per hour up to 8:15 A. M., after that it rises to 420 pounds and continues at this until noon. It then decreases until 12:30, and again rises, and at 1:15 it is 420 pounds, and remains at this until 11 P. M. Fourth, the amount of coal used for the average friction load in the winter time. It will be observed that for the same load there is a slight increase in the coal consumption owing to increased radiation, condensation, etc.

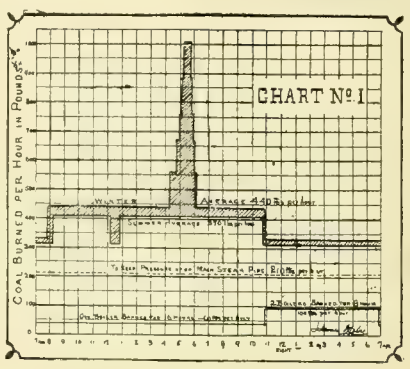
We are now ready to supply current to the external circuit, and Fig. 2 illustrates the power as indicated at the engine for 24 hours' run, summer and winter. The full red line shows the one horse power at the engine in the summer, the dotted red line the one horse power in the winter, and the full and dotted green lines the one horse power available at the service or when the wires enter the consumer's premises. You will observe as the horse power increases the distance between the red and green lines also increases. This is accounted for by the decrease in the efficiency of the external circuit and also the increase of the friction load, and you will readily understand that when the load is at its lowest the distance between these lines will be a minimum, and the only time they would coincide would be when the plant is shut down. The peak in the winter time is always an interesting figure to those in the business and no doubt deserves a word or two, for it is generally about this time that a few words are said in the power house, but whether they be good or bad I will leave that for yourselves to conjecture. I thought of plotting this peak 50 per cent. higher, but the data I have was not very reliable, so I concluded it was better to leave off at the point where it might be misleading. According to our diagram it is plotted for 1,200 horse power at the engines, and we find by looking at the green line 700 horse power are being registered at the meters, which means by deducting the correct amount for friction, losses in generators, etc, we find a loss of 25 per cent. in the line, or in other words we get at this time an efficiency of 75 per cent. between switchboard and meters. It may seem to you, or some of you, at least, that this is an enormous loss and steps should be taken to reduce it. When everything is taken into account, I think we will find it cheaper to put up with this loss than try to overcome it. It (the loss) is only for, say, 60 days a year, etc., for one hour per day, making a total of 60 hours per annum. Now, if copper were put in to reduce it we know that interest, depreciation, etc., runs on continually, and would in some cases more than offset the amount spent for the extra coal consumed during this loss. It would be an easy matter to calculate the amount spent on coal to make up this loss and see how much copper it would be equivalent to, even taking the whole amount as interest on the investment,

On Fig. 1 we showed the coal consumption per hour necessary to keep up the steam pressure to run the engines and generate current up to the switchboard. We now come to Fig. 3, which shows the amount consumed when running as indicated on Fig 2. The part in section shows the increase for the winter load, and in this we have again an interesting diagram which, when calculated out, shows very clearly the effects of forcing boilers. By comparing the run made between 10 A. M. and 12 noon, and that made between 5 and 6 P. M. in the winter time, we find there is an increase of 75 per cent. in the amount of coal burned per horse power per hour, which certainly shows that forcing boilers is far from being economical. Fig. 4 shows the amount of coal consumed per square foot of grate surface. Beginning at 11 P. M. we have 22 pounds. This continues up to 7 A. M., when a change over is made which reduces the amount to nine pounds for a short time. It then gradually increases until 10 A. M., when we get a fraction over 17 pounds. At 12 noon it diminishes to 15, and we again find at 3 P. M. it is the same as from 10 to 12, viz., 17 pounds. From 3 to 5 it averages 16 pounds, and at 6 it has reached nine pounds. From 7 to 9 it increases from nine to 15 pounds, and continues at 15 pounds for 1½ hours. The part in sections, as in the other diagrams, shows the difference between the summer and winter loads. The two peaks show the amount burned per foot of grate surface on two different sets of boilers. On one it will be seen that 43 pounds per foot are consumed and 32 pounds on the other, and to my mind shows that they are going for all they are worth.

In calculating the amount of coal consumed per foot of heating surface I find at the most economical load .322 pound is burned, and the most uneconomical load, between 5 and 6 P. M. in the winter, it is as high as 9 pounds per square foot. Let us now see what economy we are getting from the boilers.

Summer: Total water evaporated for 24 hours = 201,600 pounds.

$$\frac{201{,}600}{25{,}000} = 8.07$$ pounds water evaporated from temperature of feed or 210, which is equivalent to 8.32 pounds from and




FROM THE COAL PILE TO THE METER.

at 212° per pound coal. Allowing 10 per cent. ash, which is not excessive and compares favorably with the average of the data I have received from different plants, we get 8.97 from temperatue of feed, or 9.24 pounds from and at 212° per pound combustible.

Winter: Total water evaporated per 24 hours = 276,343 pounds

$$\frac{276{,}343}{36{,}000} = 7.5$$ pounds from temperature of feed or 200°, which is equivalent to 7.9 from and at 212°, and allowing the same percentage of ash we get 8.34 pounds from 200° and 8.78 pounds from and at 212° per pound combustible.

In the summer time, we have stated, that an evaporation of 8.32 pounds per pound of coal is obtained, and taking the coal at 12,875 B. T. U., we get a theoretical evaporation of 13.32 pounds water per pound of coal from and at 212°. This agrees fairly well with any of the tables giving the thermal units of heat of the grade of coal burned.

Theoretical evaporation = 13.32 pounds; actual evaporation = 8.32. Efficiency therefore is = 62.47 per cent., or say 62.50.

We are all more or less acquainted with the first law in thermodynamics, which may be stated thus: Heat and mechanical energy are mutually convertible, a unit of heat corresponding to a certain fixed amount of work called the mechanical equivalent of heat. We can calculate the mechanical equivalent of the coal pile thus:

$$\frac{12{,}875 \times 772 \times 25{,}000}{24 \times 60 \times 3{,}300} = 5229$$ horse power.

$\therefore$ $5229 \times .6247 = 3262.5$ horse power available at the stop valves of the boilers, which, if all were utilized, would give us 3.1 horse power per pound of coal per hour, or a little over .31 pound coal per horse power per hour, a result which, with the greatest refinement in engineering, has not yet been attained in practice, and I think I am safe in saying, never will.

We will now calculate the efficiency of the steam:

Average steam pressure, 125 pounds absolute.
Average exhaust pressure, 20 pounds "
Water per horse power per hour, 28 pounds.
Temperature of feed, 210° Fah. (Summer.)
Temperature of water before entering heater, 40°.

125 pounds abs. = 1187 units. Feed water raised from 40° to 210° = 170° by heater.

$\therefore$ $1187 - 170 = 1017$ thermal units of heat expected per pound of steam.

$$\text{Thermal units per I h. p. per minute} = \frac{1017 \times 28}{60} = 474.$$

$$\therefore \frac{42.75}{474} = .09$$ or 9 per cent. efficiency.

Taking the temperature of the feed at 210 and that of the steam at 344°, we get

$$\frac{344 - 210}{805} = .168,$$ or an efficiency of 16.8 per cent.

if same were a perfect engine working between the limits of the temperature 344° and 210°. Therefore the relative efficiency between the perfect engine and the above is

$$\frac{.09}{.168} = 53$$ per cent.

By the above reasoning we get an efficiency of 9 per cent. of the total power available at stop valves of boilers:

$3266.5 \times .09 = 293.98$ h. p.

our actual h. p. is 230 or 78.23 per cent. of 293.98

$\therefore$ $.9 \times .7823 = .070407$, or a fraction over 7 per cent.

1. Read before the Canadian Electrical association, Ottawa, Ont., September 17, 1895.

represents the efficiency of engine to boiler, and calculating to coal pile, we get an efficiency of $.625 \times .09 \times .7823 = .625 \times .070407 = .044$, or a net efficiency of 4.4 per cent.

We also find from actual results that a mechanical efficiency of 82.3 per cent. is obtained from the engines; that is to say, it takes 17.7 per cent. to overcome friction and run generators up to speed.

Therefore the power available for running the generators is

$$230 \times .823 = 189.29 \text{ h. p.}$$

Efficiency of generators not less than 92 per cent.

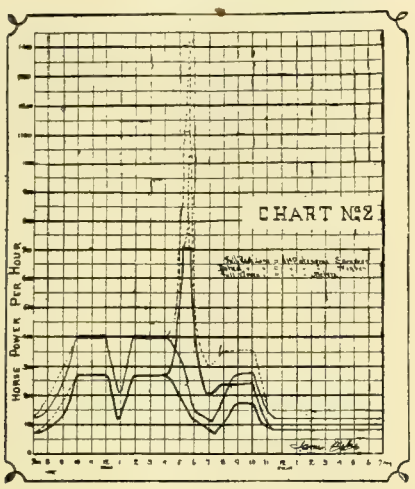
$\therefore 189.29 \times .92 = 174.14$ h. p. available for sending out to the line, and from boiler to switchboard we have

$$.09 \times .7823 \times .823 \times .92 = .0533$$

or briefly, $\frac{174.14}{3266} = .0533$, or $5\frac{1}{3}$ per cent. efficiency,

and going back to coal pile we get $.0533 \times .1247 = .0333$ or $3\frac{1}{3}$ per cent. efficiency.

We have got one more item to take into consideration to complete our calculations, and that is the efficiency of the

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external circuit, which is in the summer time 85 per cent. Therefore the total horse power available at the meter on the premises of the consumer is $174.14 \times .85 = 147$ horse power fully, or more accurately $3266 \times .09 \times .7823 \times .823 \times .92 \times .85 = 148$ horse power.

The net efficiency from boiler to meter is

$$\frac{148}{3266} = .0453 \text{ or } 4.53 \text{ per cent.}$$

and from coal pile to meter we get $.0453 \times .6247 = .0283$ or 2.83 per cent.

From the above we get the following results:

| | |
|---|---|
| Power for running generators | 100 |
| Power available at switchboard | 92 |
| Power available at meter | 78.20 |

Efficiency of the electrical apparatus, including outside circuit = 78 $\frac{1}{2}$ per cent.

| | |
|---|---|
| Engine | 100 |
| Available for generating current | 83.3 |
| Available at switchboard | 75.72 |
| Available at meter | 64.35 |

The commercial efficiency from engine to meter is 64.35 per cent.

| | |
|---|---|
| Boiler equivalent | 100 |
| Indicated horse power at engines | 7.04 |
| Available for generating current | 5.79 |
| Available for switchboard | 5.33 |
| Available at meters | 4.53 |

The efficiency therefore from the boilers to the meter is 4.53 per cent.

| | |
|---|---|
| Coal pile equivalent | 100 |
| Available at stop valves of boiler | 62.47 |
| Indicated horse power at engine | 4.4 |
| Available for generating current | 3.62 |
| Available at switchboard | 3.33 |
| Available at meter | 2.83 |

The above extended results apply, as has already been stated, to the summer load, but as the results from the winter load are practically the same, I need not take up your time going over them.

We see, therefore, that the electrical end shows up exceedingly well. For every 100 horse power at the engine, 82.3 are utilized for generating current, and 75.77 of these are sent out to the line, which, although it could be improved on, leaves very little to be gained by any new invention or alteration that may hereafter be made.

Regarding the steam end, there can be no doubt that considerable attention has been paid to it, and it is still receiving more. Yet it does not alter the fact that it is here where we get the worst showing. When some of the great scientists arrive at the method of abstracting electricity direct from the coal pit or even the boiler without the intervention of the steam engine, better results may be obtained.

I see in some of the engineering papers that evaporation condensers are coming into use and are being applied to plants that have heretofore been running non-condensing. This is a step in the right direction, and as no more water is used than that required for steam purposes, parties at present having to pay for their water might find this a profitable investment, inasmuch as a vacuum of from 22 inches to 26 inches is readily obtained, in fact, guaranteed by the builders.

## Fires of Electrical Origin.[1]

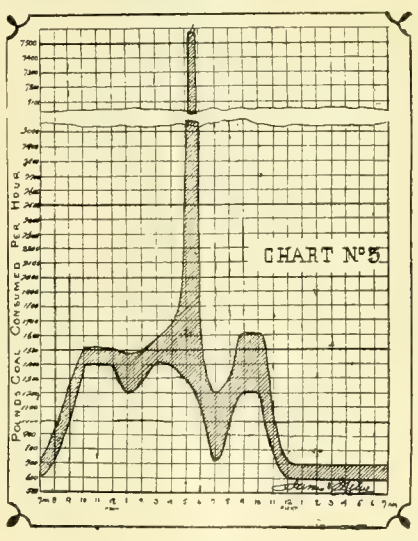
By William H. Merrill, Jr.

During the last two years the electrical inspectors of the United States have co-operated in compiling accounts of the circumstances leading up to all electrical fires and burnouts which have come under their observation. These accounts have been condensed and issued in the form of quarterly reports so that all of the inspectors could receive the benefit of knowing what causes were producing electrical fires outside of their own territories. We have thus far on record accounts of nearly 1,000 such electrical fires. These do not, of course, represent the total electrical fire waste, because there are only about 40 electrical inspection departments in the country, and because so many fires destroy all evidences of their origin. Incomplete as they are they nevertheless have the advantage of being wholly accurate, and of covering portions of the country having different climatic conditions and where somewhat different practices are prevalent in the manner of installing electrical systems. The aim in obtaining these accounts has been to secure an approximate comparison of the fires due to different electrical causes and not to receive accurate accounts of losses. The detailed accounts given of fires in which no loss resulted have proven of greater instructive interest than the ones in which losses were paid, because the exact cause and conditions could be more accurately determined. Fires resulting in large losses generally destroy evidences of the cause and but few large fires are included in the reports. Thus, for the first year during which the reports were collected the total loss reported amounted to only $1,415,610.25. This, of course, gives no idea of the annual electrical fire waste and can only serve as a known fraction upon which to base an estimate of the total.

It is not, however, to the loss account but rather to the exact and specific causes of these fires that inquiry should be made, for it is there that the remedy can be found.

A comparison of causes among 815 electrical fires published in the first eight reports shows that 113, or over one-seventh of these losses, were caused by the crossing of telephone, telegraph and similar wires with trolley or electric light wires. Heavy current flows established by such accidents through telephones, telegraph instruments and switchboards always result in damage to these devices, and oftentimes in their destruction, and the communication of fire from them to surrounding combustible material. The total loss due to these 113 fires was $324,957.50, which is a pretty large sum to charge to accidents which must be considered preventable. Assuming, then, that a large percentage of electrical fires are caused in this manner, let us look for the remedy.

Removing conducting wires from exposure to the elements is the only absolutely certain way of overcoming all of the danger threatened by aerial wires, as it is the only cure which strikes at the root of the evil. By this means the chances of contact between wires of different systems is reduced to a minimum, and the hazard from lightning entirely eliminated. The cry, "bury the wires," has been successfully raised in many of the larger cities of the country, and laws and ordinances have been enacted requiring elec-

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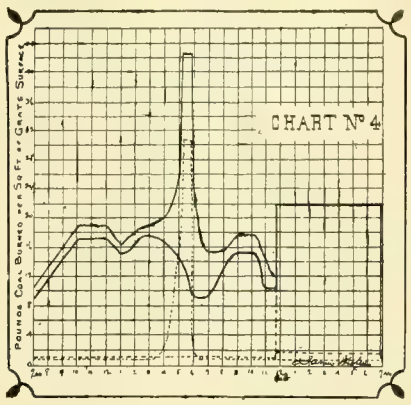
tric conductors of all or of certain classes to be placed underground.

It would seem that the experiences of the larger cities in this matter would serve as useful examples to the smaller ones where electric equipments are growing at all extensive. Almost without exception the movement to place wires underground has come after the poles and roof structures of a city have grown to such numbers as to mar the appearance of the streets. Then after a great amount of money has been spent in overhead construction the electric companies have been called upon to tear it all down and go to the additional expense of installing underground work. It will be seen that the entire original outlay could have been saved by using underground systems of distribution originally. The way in which history is repeating itself in different parts of the country in this matter ought to serve as a useful lesson to all managers of electrical enterprises whose business depends upon aerial wires, and the manner in which losses from this cause are accumulating ought to serve as a sufficient reason for every underwriter to miss no opportunity to oppose outside overhead electrical construction work, or to call attention to the advantages to be gained from a fire, life or esthetic standpoint by running electric wires underground. No great technical knowledge is needed to enable one to advance convincing arguments on the disadvantage of aerial wires, and it will often be found that comparatively little influence is necessary to start such a movement along the road to success. Many of the cities of the West offer fruitful fields for work of this kind, and a little of the time of every field-man could be profitably spent in agitating the subject when opportunities present themselves. In country districts, where the cost of underground electrical construction would be prohibitive, care can be exercised in providing guard wires and in installing protective devices where wires enter buildings, but these are, perhaps, matters to be treated by the electrical companies and the district inspector rather than the field-man.

It is unfortunate that trolley companies have installed their roads in so many places without any regard to the

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telephone or telegraph wires running above them, and that telephone companies have been so backward in designing and installing efficient devices to place in their circuits for the protection of their instruments. Like in a great many other admirable and perhaps necessary things, the item of expense has held back improvements of this kind, though the outlook for obtaining respect for other people's rights in this particular from these corporations becomes more hopeful as accidents to life and losses by fire, due to this negligence on their part, become more numerous and apparent. Such occurrences as those referred to in the following reports, for instance, tend occasionally to direct attention to the subject:

Fire No. 712: Cross between telephone and trolley wire. Pole on the trolley car raised the trolley wire so that it came in contact with a telephone cable stretched above it. Forty-two of the 75 telephones connected to the exchange were burned out and the switchboard ruined.

Fire No. 479: "We had a severe storm here on the 26th which played havoc with overhead wires on the streets. A large number of the telephone company's new distributing poles, 90 feet in height and 18 inches in diameter, were broken and fell, letting down wires in all directions. Together with this, nearly all overhead wires were disabled and crossed with electric light and trolley wires. The trolley railways were interrupted for several hours; ten horses were killed on the streets; hundreds of telephone, telegraph, and fire-alarm signal boxes were burned out. Singular to say, only two fire losses were reported. The origin of one of the fires was plain to be observed, and is suggestive. A high tension current was conducted over a burglar alarm wire into a building, and at the point where the wire was grounded on the gas pipe the current pierced a hole in the pipe and ignited the escaping gas, which set fire to the surrounding woodwork. Damage about $50."

Next in importance to aerial wires comes wooden base devices, that is, electrical switches, cutouts, and uninsulated current carrying strips, bars and connections of all kinds which are mounted directly on woodwork instead of on porcelain, slate, marble, or some such non-combustible material.

Wood used for bases for such devices is responsible for 67, or one-twelfth of the 815, fires given in the first eight reports, and for a total loss of $116,027. Under this heading is not included wooden cleats or similar supports which come in contact with the insulated covering of a wire. By wooden base devices are meant only such as have bare current carrying parts mounted directly on wookwork.

Burnouts from this cause are very numerous and I know the reports show but a very small fraction of the total troubles from this cause, as hundreds of them result without loss. Exactly why it was ever supposed wood was a proper material for mounting electrical contact devices on I cannot explain. Fortunately to-day the manufactures have nearly all learned a lesson, but unfortunately for the insurance interests they sold a great amount of material before finding it out, and they didn't give a 10 year guarantee with any of it.

On account of this mistake of the electrical manufacturer the insurance field-man must remember that where risks are equipped with wooden base cutouts, switches, hanger boards for arc lamps, rosettes and similar appliances, that a fire will result just as soon as a loose connection is established to generate heat enough to ignite the wood. And so the record runs through specific causes such as sparks from arc lamps, heating effects of incandescent lamps, and overheating of wooden encased resistance devices, and through

1. Read before the Fire Underwriters Association of the Northwest, Chicago, September 25, 1895.

general causes due to defective systems such as the operation of lamps and motors, by current supplied from trolley wires and the many troubles which lead up to break-downs in transformers and result in conveying pressures of 1,000 volts onto interior wiring systems designed for 50 or 100 volts. The total cost of these happenings to the insurance companies may be $3,000,000, or may be $5,000,000 annually. We have proved that it is over $1,500,000, and we know that whatever the total may be it is altogether too large, and that greater effort should be made to prevent it by the electrical manufacturers, the lighting companies, architects, municipal authorities, the public generally and the insurance companies.

We have recently found an easy and effectual way of enforcing complaints against the manufacturer by the formation of the Electrical Bureau of the National Board, under whose direction defects discovered in any electrical device are portrayed in pictures and words and the reports distributed to the various insurance associations and companies of the country, and other people interested. This always leads to improvement in the manufactured article. The lighting companies always will be troublesome, because there are so many of them so widely distributed, because they all wish to sell current, and because they find it easier to obtain customers if the cost of installation is cheap. There are a few exceptions to this rule among companies supplying current who do not do construction work, but many of them, like the majority of the electrical contractors of the country, do not consider good practices or the safeguards necessary to prevent fire other than as decided hindrances to what they are pleased to consider their legitimate business.

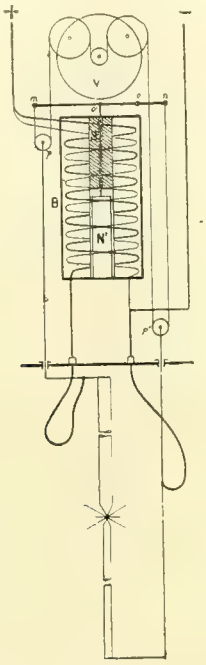


FIG. 1. NOVELTIES IN ARC LAMPS.—BARDON LAMP; CONSTANT INTENSITY.

The architects from necessity are becoming more or less informed on electrical matters and some of them have the good sense to employ specialists in this field. Slowly but surely municipal and state authorities are seeing the necessity of exercising supervision over electrical installations and the number of municipal electrical departments increases every year. The people generally, or such of them as secure a common education, will eventually, of course, take this matter into their own hands and of their own knowledge prevent the frauds perpetrated by electrical contractors and the installation of a good deal of unsafe wiring.

Electricity is becoming so common to our everyday life that the schools must teach its laws, and therein lies the true solution of the problem. I am afraid there will never be much to hope for from people like our friend whose experience is recounted in the report on fire No. 701. Upon retiring to his room in a hotel he attempted, through lack of familiarity with the apparatus, to blow out an incandescent electric light. Failing in this he wrapped a towel around the lamp and went to bed. Some time in the night the heat from the lamp ignited the towel and the gentleman was taken from the room by the firemen in an unconscious condition, having been partially suffocated by the smoke.

To those who live in cities, however, electricity is becoming daily more common and two or three generations hence we may hope to see the occupants of some of our mercantile buildings intelligently doing their own wiring.

The insurance companies have done a great deal toward informing the public on electrical matters, and it is certain that they can economically do more with beneficial results. A little knowledge is not always a dangerous thing, and each one of you could perhaps pick up something in this line which it would be well to tell your neighbor, especially if he is insured in your company and is using electricity.

If everyone could only know and appreciate the facts that wires ought to be underground, that wooden base electrical devices are poor things to have around the house, that arc lamps give off sparks, that incandescent lamps get hot, that wires should be kept free from grounded pipes, and the other useful little lessons that these electrical fires teach us, how much better your loss accounts would appear.

The insurance men throughout the great Northwest are certainly competent to learn and repeat some of these mottos, and I am certain that if they all would attempt it a great amount of benefit must ensue.

## Novelties in Arc Lamps.

There are seasons when there is a tide of invention which everywhere seems to set in a given direction. Whether it is in the wind or the temperature, the barometer or the hygrometer, we know not; we only see the results. The incandescent lamp was in the ascendant not long since, and from everywhere, Europe included, there came a glow lamp, in each case better, always longer lived, most surely—everything considered—cheaper. Some one bethought him that a reducer on an incandescent lamp would be a good thing, and almost instantly the electrical papers were so full of them that one could almost feel their weight in the unopened wrapper.

The constant potential arc lamp fad was an epidemic, and, though somewhat discouraged in many cases, it is still a Jim Corbett, dancing about the ring. Among the latest of these which have a certain amount of originality are those of L. Bardon, a sample of which is shown in Fig. 1.

The inventor calls this a special constant intensity type. It consists of a solenoid *B* placed in the axis of the lamp, which comprises the spool proper, two cylindrical cores and the winding. The spool is formed of a copper tube, at the two extremities of which are two cheek pieces of iron, united by iron armatures which serve the purpose of closing the magnetic field.

The two cores *N* and *N'* in the interior of the bobbin are differently attached. The upper one, *N*, is fixed solidly, while *N'* is movable and has a prolongation extending upward through *N*.

The core *N'* has its lower extremity terminated by a square portion which slides in a socket, the latter pierced by 10 holes around its periphery, the use of which will be seen by and-by. The upper portion has a prolongation running upward through the fixed core *N*, and, taking hold of the lever, which in its ascent acts as a break to check the movement of the wheel *V* by pressing against it. This prolongation has a thread on its upper extremity.

The winding of the spool, as shown, is differential, the two wires, coarse and fine, being wound reversed to each other, the fine wire being connected in derivation. A cord of silk passes over three pulleys, connected with the wheel, or rather over two and under one, this last being fixed on the shaft of the wheel. This cord also passes under two other pulleys—not fixed—in different directions, and terminates at the extremes of the lever *mn*, the fulcrum of which is at *o*. The attachment of the core *N'* is at the center of this lever, and, of course, as it rises or falls motion will be communicated to the cord, permitting of the rising or dropping of the carbons, or, in other words, the regulation of the feed. Fig. 2 shows the lamp entire.

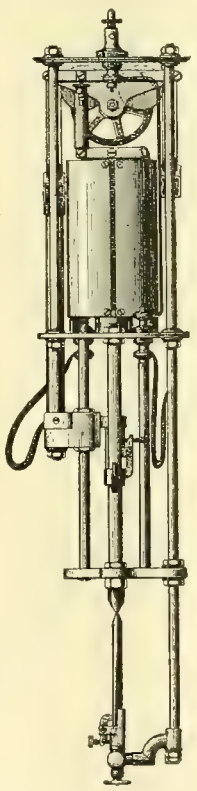

FIG. 2. NOVELTIES IN ARC LAMPS.—BARDON LAMP; COMPLETE CONSTANT INTENSITY.

Mr. Bardon is possessed of a spirit of unrest, and it is impossible, apparently, for him to do something once for all in the best possible manner. Fig. 3 shows a second combination of pulley and axle movement for accomplishing the same regulation, and Fig. 4 shows this lamp stripped of its case.

The action of these regulators when lamps are hung singly is simple in the extreme. The weight of the upper carbon bears it down and closes the arc gap. Current being turned on, the lower core is suddenly drawn upward, the lever strikes the wheel and temporarily holds it. The carbons are separated, the arc is formed. Gradual burning away of the carbons increases the resistance by widening the gap, the intensity of the current decreases. There is consequently less magnetic pull on the core *N'*, there is less and less pressure on the brake until the weight of the upper carbon closes the gap and restores the equilibrium.

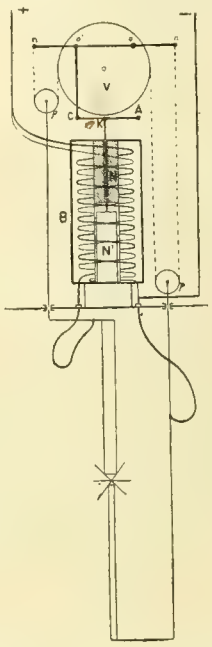


FIG. 3. NOVELTIES IN ARC LAMPS.—BARDON LAMP; SECOND TYPE CONSTANT INTENSITY.

When two lamps are mounted in series the most sensitive lamp regulates first. During this time the arc of the second lamp will tend to grow larger and larger, and but for the counter action of the small wire of the solenoid would possibly become excessive.

The adjustment of the lamp is accomplished by means of a thread on the rod from *N'*. This permits of lengthening or shortening the core, by turning the latter, and when the adjustment is complete a pin is thrust through one of the 10 holes previously mentioned, in the periphery of the socket.

Mr. Bardon's inventions are versatile. They are as applicable to the constant potential as to the constant current model.

Figs. 5 and 6 illustrate one of the former, which shows but trifling changes from the lamp just described. The winding is different, being of fine wire in derivation around the lamp, and the action of the brake upon *V*, in this case is constant. A compensation spring, *R*, is placed between the two levers *A K C* and *O F G*, which only acts at the moment of lighting to separate the carbons. In repose, the lever *O F G* holds *V* by its own gravity at *F*. On the other hand, the lever *mn*, to the extremities of which the carbon holders are attached, has its equilibrium destroyed by the weight of the lower carbon, which tends to descend when the upper carbon rises, which, of course, tends to form the arc gap, the wheel being held fast.

Now, current being turned on it passes through the solenoid. The movable core *N'*, aided in its first action by the spring *R*, oscillates the lever *mn*, of which the extremity *n* soon reaches the stop *G* and raises the brake lever *O F G*. The brake having relieved the wheel, the carbons come in contact, the arc is formed, the current passing the gap in accordance with Ohm's law. The resistance of the coil being such that only a minimum current flows through it releases the core *N'*, which descends, carrying the lever *mn* with it. The brake lever *O F G* holds the wheel in place, and the extremity *n* of the lever *mn* does the adjusting of the arc by descending.

The carbons burn apart, the arc resistance increases, and the voltage in the shunt rises, creating an increasing magnetic pull on the core *N'*, and gradually then end of the lever *mn* rises until it reaches the stop *G*. This action and counteraction is said to be so gradual as to bring the feed movement quite near perfection. The illustrations are from *L'Electricien*.

## Are we Laying too Many Miles of Track to Reach a Few People[1]?

By W. W. Cole.

It is an established fact that as the mountain would not go to Mohammed, he had to go to the mountain. The fact is just as self-evident in the location of track, that if you stop one block from where the dividing line comes, between the settled district and the open field, the people will walk that one block to the cars; and the maintenance and operation of 1,500 feet of track for one year on a 15 minute headway, at 9 cents per car mile, means the interest at 5 per cent. on $26.864 or $3.68 per day. It can be readily seen that with many lines extended just beyond the line of population, the road has extended just beyond the line of dividend. It is conceded by all that, when a new line is constructed, we have to educate the people to ride, as they have become accustomed to depend on the horse or bicycle, or to walk. Now, if we extend our lines beyond the population, we immediately become a professor of education, as we must not only educate the existing population to ride, but must educate the people to build on the open territory and educate people to move into the houses built. If we keep within the lines of existing population, we have the advantage of a general located on an eminence—we can wait and see which way the population army moves, and then we make no mistake in our extension. In other words, the railroad is practically the army sutler, and there is no instance where the sutler led the army.

There is no denying that a railroad extended into open territory will increase the value of real estate, and eventually build it up; but, in the meantime, we are wearing out rolling stock and track for the owners of real estate, and should receive a bonus sufficient to carry the road until the open territory is sufficiently populated to support a road.

It is the general experience that by the time the fields become populated, the rolling stock must be replaced, and the track repaired, or we practically build a new road to suit the new condition, and outside of the benefit to the real estate owners, we only get our returns when the new road is built for the actual needs of the existing population.

A road built in an unpopulated district has to contend with more dust and mud upon its rails, which means wear and tear, and without sewers there are bound to be places in the track where it will be covered with water, which is deleterious to motors, track and car bodies.

We will cite as an illustration a city of 40,000 inhabitants, which has 20 miles of track; five of the city lines extend 2,112 feet beyond the settled territory, or two miles of track, with but little traffic. Taking an average of 10 cities of 40,000 population, the riding per capita is 46 times per year. This would give in gross receipts $92,000; operating expenses 70 per cent. of gross receipts, or $64,000, and $27,600 net receipts. The average road is bonded at

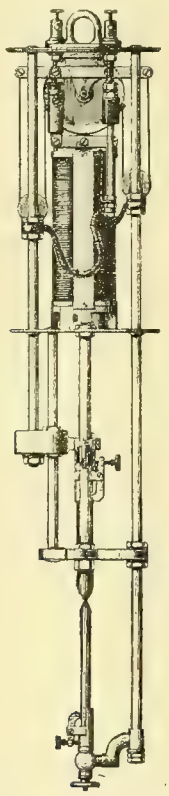

FIG. 4. NOVELTIES IN ARC LAMPS.—BARDON LAMP; SECOND TYPE COMPLETE CONSTANT INTENSITY.

the rate of $30,000 per mile, or $600,000 for 20 miles of track. The interest at 5 per cent. would be $30,000. This would show a deficit of $2,400 on interest.

Now, in this city of 40,000 inhabitants, we have two miles of track operated and bonded that for the present we get no returns from, as it was built to promote the building of the city at different points, and like the man who has lived a good life on earth, we are looking forward to a future reward; but the man is invariably dead when he receives it, and the results in street railroading show that they are waiting for the sound of the horn in the hands of the receiver.

In this city of 40,000, if but 18 miles had been built and bonded for $540,000, with an annual interest of $27,000, we could have shown at least $600 surplus, and with the modern methods of increasing traffic, this surplus could undoubtedly be increased to pay the stockholders a fair rate of interest if 18 miles were built instead of the 20.

If for obvious reasons it becomes necessary to extend the track beyond the populated limits, care should be taken to focus the promoting energy upon one line, and to extend no other lines until the one so extended has been so populated that that line shall be self-supporting, as with the extension of several lines in different parts of the city, the various interests become separated and each line so extended only receives a very widely scattered population, that must take years to promote into a paying territory.

Precaution must be observed in running out suburban

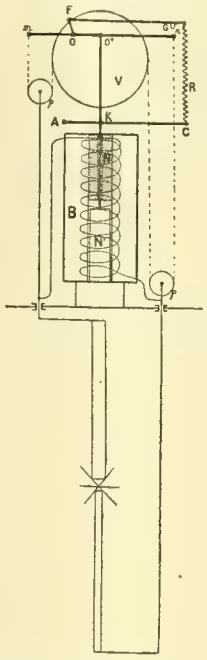


FIG. 5. NOVELTIES IN ARC LAMPS.—BARDON LAMP; CONSTANT POTENTIAL.

lines for park and pleasure resorts, as we can only count on three months of pleasure travel, and a line built for pleasure travel only is apt to prove a problem with an unknown quantity. On the other hand, all parks and pleasure resorts introduced along existing lines, even though built at a considerable expense, if properly managed, will prove a booster to the net receipts of the lines favored.

In locating pleasure resorts, if possible, they should be placed on lines connecting two towns, as then you promote traffic in both directions, and are not to a large extent paying for an empty mileage in one direction; and you are also promoting traffic to the thinly populated section of your road. To clinch my argument, I will quote from an editorial in the *Street Railway Journal:* "The total street railway mileage of the United States is approximately 6 per cent. of the steam railroad mileage. About 6 per cent. only of this mileage is at present in the hands of receivers, as against about 25 per cent. of the steam railroad mileage. The gross earnings of all American street railway properties are probably slightly less than 15 per cent. of the combined freight and passenger earnings, but are nearly 50 per cent. of the passenger earnings alone of the steam railroad properties, while the net income applicable to dividends on capital stock is hardly less than 35 per cent. of the steam railway income. These results are surprising indeed. That 14,000 miles of street railway track should be able to earn half as much gross on passenger traffic, and one-third as much net (for dividends) on combined passenger and freight traffic, as is earned on 234,000 miles of steam railroad track; this is certainly a remarkable showing, and one which points to a very reasonable cause for a capitalization per mile of track larger for the street railway than for the steam railway properties."

When we have carefully considered the subject of this paper, "Are We Laying Too Many Miles of Track to Reach a Few People?" the results of a comparison between the steam and street railroads are not so surprising, as there is no doubt if the cities could all be moved within a few miles of one another along the lines of the steam railroads, that their passenger receipts would show an immense increase and a corresponding decrease in operating expense.

Even though the steam road charges 3 cents a mile, and the street railway often gets less than 1 cent a mile, we find that the receivers' hands and pockets are being filled by the steam roads, because even at 3 cents per mile enough passengers must be carried to support a lengthy mileage through the unpopulated country.

1. Read before the Street Railway association of New York State, Albany, September 17, 1895.

## American Street Railway Association.

The usual preliminaries have been arranged for the fourteenth meeting of the American Street Railway association, which will be held at the Windsor hotel, Montreal, Ont., on October 15th. According to the circular sent out there will be considerable variety in the proceedings, and those who desire to discuss practical questions and examine the latest devices or the most improved machinery can have their wants satisfied as well as those who will make a sort of holiday of the occasion. Papers and discussions on the following-named topics are announced in the preliminary programme:

Transfers.
Municipal ordinances.
Labor question. Wages paid to employes.
Experience of roads in furnishing free music and other entertainments to the public.
Physical operation of roads.

The executive committee has secured Victoria rink for the exhibition of supplies of every nature used in the street railway business. The building has been engaged for two entire weeks, beginning October 9th and ending October 22d, thereby giving ample time for the setting up and removal of the largest exhibits. The hall for the meeting is adjacent to the exhibition building, and delegates will therefore be enabled to examine the exhibits to the best advantage and with the least possible loss of time. The exposition will be in charge of Stonewall Jackson, 27 St. Sacrament street, Montreal.

The committee having charge of the arrangements for the transportation announces that a special train will leave the Grand Central Station, Forty-second street, New York, Monday, October 14th, at 6 P. M., arriving in Montreal Tuesday morning, October 15th, in time for breakfast. A dining car will be attached to the train leaving New York. Passengers from all points West can connect with the special at Utica, Monday night.

The traffic associations have authorized the sale of tickets at reduced rates, namely, a fare and one-third for the round trip. This concession applies to all attending the meeting, delegates, supply dealers and accompanying friends. The traffic associations that have extended this courtesy are the Trunk Line association, the Canadian Pacific company, the Central Traffic association and the Boston Passenger association.

Those desiring to take advantage of the reduction in railroad fare should examine the conditions imposed, as a strict compliance will be required. The secretary will, of course, furnish information on this subject to any person desiring to attend, whether a member of the association or merely an interested visitor.

The banquet of the association will be held on Thursday evening, October 17th, when the serious business of the convention shall have been concluded, and everybody

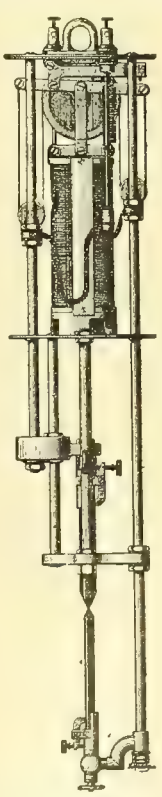

FIG. 6. NOVELTIES IN ARC LAMPS.—BARDON LAMP; COMPLETE CONSTANT POTENTIAL.

will be ready to join the festivities. These annual banquets have grown to be very enjoyable affairs, and this year, it is promised, it will be made the social feature of the meeting. The officers of the organization are anxious to extend the influence of the association, and they are exerting every effort to secure the attendance of men not yet admitted who are desirous of learning more about the aims and influence of the society. The meeting is considered an assured success.

An eastern company is endeavoring to secure a franchise to construct an electric railway line in Parkersburg, W. Va.

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CORRESPONDENCE relating to electricity or any of its practical applications, is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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THERE is nothing particularly novel in Dr. Emery's paper on the "Cost of Steam Power." He treats the subject in a thoroughly practical manner and considers it as a purely mathematical problem. Those who have a fondness for figures will find this article to their liking. Moreover, the data presented will prove valuable to all engaged in enterprises requiring large consumption of steam power. It would be well, too, for those who lend a willing ear to every claim that is made for cheap water power to give this article serious attention. It is worthy of their consideration.

WHEN steam railway men take the trouble to decry trolley roads it is safe to assume that the latter are making inroads into the earnings of the former. For this reason too much weight should not be given to the clamorous opposition which many big railroad companies have started during the last year. It would be much more sensible for these corporations to take advantage of the innovation and wherever possible utilize electricity upon their lines. This could be done in many places where there is heavy suburban traffic, and there is no doubt that unless the steam roads do something of this kind they will find that their suburban traffic will pass from their control. There is no doubt that they could with their present track equipment in many places give far superior service by adopting an electric system than could a newly formed company without experience and without a plant. In the case of the Nantasket road referred to in another place this week, the steam railroad company has found that the electric road is well adapted to suburban service and it has accordingly worked out a comprehensive plan for the equipment of several lines. Other companies are engaged in similar work. In Chicago the matter has been under consideration for two years and there is no doubt but that the big steam railroad companies will be obliged to adopt electricity for suburban service at least, in order to compete with the rapidly extending trolley lines.

JUST now street railway matters are occupying more attention than any other department of electrical activity. This is the season when the principal state association meetings are held, and the event of the year, the convention of American Street Railway association, is now at hand. The preliminary arrangements have been completed and the programme gives promise of an interesting meeting. The policy of the organization in going to Canada this year is commended by all who are desirous of extending the application of the electric motor to Canadian street railways. In the report of the proceedings of the Canadian Electrical association, published in last week's issue of the WESTERN ELECTRICIAN, attention was directed to the activity already displayed in this field and the necessity of safeguarding the interests of legitimate projectors and investors in these enterprises. The Montreal meeting will consider the subject of "Municipal Ordinances," and under this head, no doubt, members may express their views on this subject. By the way, what do the members of the association think of the Toronto street railway, the terms of the ordinance which the city fathers passed when the company's old franchise expired, and the statements freely and frequently made in this country that similar conditions should be imposed here?

UNDERWRITERS are devoting more and more attention to the subject of electrical fire risks, and it is encouraging to notice that they are giving more intelligent consideration each year to this examination. Under the guidance of the experts representing the several sections of the country, the National Board of Fire Underwriters has taken up the subject on a thoroughly systematic plan, and has thus far conducted the work in a scientific manner. It is a matter of especial interest that the returns have all been tabulated, and that a complete record of the fires known to have been caused by electricity has been made, together with the amount of damage done and the conditions attending each fire. With such a record at hand construction companies can profit by this experience, and all who are interested can learn the defects in apparatus or methods of construction and operation that should be guarded against. In Mr. Merrill's paper, printed in another column, the statement is made that "a comparison of causes among 815 electrical fires published in the first eight reports shows that 113, or over one-seventh of these losses, were caused by the crossing of telephone, telegraph and similar wires with trolley or electric light wires. Heavy current flows, established by such accidents, through telephones, telegraph instruments, and switchboards always result in damage to these devices, and oftentimes in their destruction, and the communication of fire from them to surrounding combustible material." The writer advocates removing conducting wires from exposure to the elements as the only absolutely certain way of overcoming all of the danger threatened by aerial wires, as it is the only cure which strikes at the root of the evil. By this means the chance of contact between wires of different systems is reduced to a minimum, and the hazard from lightning is entirely eliminated. Attention is called to the fact that the cry "bury the wires" has been successfuly raised in many of the larger cities of the country, and laws and ordinances have been enacted requiring electric conductors of all or of certain classes to be placed underground. The fault is not entirely with any particular class of construction, for, as Mr. Merrill points out, it is unfortunate that trolley companies have installed their roads in so many places without any regard to the telephone or telegraph wires running above them, and that telephone companies have been so backward in designing and installing efficient devices to place in their circuits for the protection of their instruments. The returns already referred to show that next in importance to aerial wires come wooden base devices, that is, electrical switches, cutouts, and uninsulated current carrying strips, bars and connections of all kinds which are mounted directly on woodwork instead of on porcelain, slate, marble, or some such non-combustible material. Furthermore it is well known that many burnouts from this cause are never reported. The most practical and effective means yet discovered for securing immediate attention and correction where faults in apparatus and construction are found is to have these defects portrayed in pictures and words and the reports distributed to the various insurance associations and companies of the country, and other people interested. This always leads to improvement in the manufactured article. If everyone cou'd only know and appreciate the facts that wires ought to be underground, that wooden base electrical devices are poor things to have around the house, that arc lamps give off sparks, that incandescent lamps get hot, that wires should be kept free from grounded pipes, and the other useful little lessons that these electrical fires teach us, Mr. Merrill thinks, the public generally and the electrical fraternity and insurance companies particularly would be greatly benefited.

WHAT Mr. Cole says in his paper on the practice of going after street railway patronage will interest street railway managers, but it will not be in accordance with the experience of many of the most successful projectors of street railway enterprises. There is no doubt that the ideal method is that described by Mr. Cole, but it is equally true that one would have to wait a long time before finding the conditions existing. People, nowadays, do not build up towns, extend the residential portions and then invite the street railway company to place tracks and operate cars in such a district. The first question that is asked by a person seeking a home in a new quarter of a large town is: "What transportation facilities are offered?" A perusal of the real estate columns of any daily newspaper will convince the reader that this is a most important consideration. The larger the city the more noticeable will this feature be. But, in a city of 40,000 inhabitants, such as that cited by Mr. Cole as an illustration, it may be contended that these demands will not be as pressing as in large cities. That is very true, as is also the statement that if there were no street cars at all we would all be able to exist very nicely. There is no reason why street railway men should not create a demand for improved street railway facilities and educate the people to ride frequently, even though they only desire to go a short distance. Others stimulate trade, and merchants are constantly devising means of securing new patrons and keeping their old customers satisfied. Then why should not the street railway company extend its lines and thereby its field of operation, always, of course, within reasonable limits? We are told that the average town of 40,000 inhabitants can support a certain equipment. This is very misleading and it is a very poor rule to follow. The conditions are not the same in all towns of 40,000 inhabitants, nor do two towns of practically the same size although in one state always transact business by the same methods or live on the same general scale. Some towns of 40,000 inhabitants support better street railway systems than others of 50,000 or 60,000. Local conditions and aspirations have much to do with it. Then, too, changes are being constantly made in the people themselves, and in their methods of living, their requirements and their willingness to support enterprises of this character. For instance, there is a city in New York, represented in the convention at which Mr. Cole read his paper, which illustrates what has been said here. Although the city comprised a wealthy, energetic and public spirited community, and was in point of population one of the leading cities of the state, it had a wretched street railway service furnished by one company which employed bob-tail cars without conductors, dragged along at a snail's pace, one horse to a car. The driver made change when required and each passenger placed his nickel in a box at the front of the car or "passed it up." The company figured that this arrangement saved paying conductors and it had persuaded the people of the city that it could not afford to run cars as often if conductors were insisted upon So the people continued to tread on each others' toes in getting up to the front of a crowded car in search of "change," and there was much grumbling, but they consoled themselves by reflecting that they were contributing to the general welfare by dispensing with conductors. However, a day came when a new company was formed to compete with the old corporation, but which eventually superseded it. Then the people realized for the first time how great had been their mistake. Instead of old-fashioned, one-horse, conductorless "bob-tails," they were given large, well finished cars propelled rapidly by electric motors and in charge of conductors. And, to the surprise of all, the change proved to be a profitable one, for the people rode more and more every day and they became accustomed to relying upon the street cars. Now, the company has an expensive equipment, is employing more men than formerly and is making far more money than the old concern. But the projectors of the new company did not rest content with established conditions. They went after new business and they contributed their share to the development of the town. They built new lines and extended old ones. They reached out for summer traffic and encouraged the establishment of new resorts. In a word, they disregarded the letter and spirit of the policy followed by the old corporation, which was in fact in line with that outlined by Mr. Cole, and the success that attended their efforts proves the wisdom of their course. This does not prove that Mr. Cole is necessarily wrong, but it does mean that in some cases it would be folly to adhere strictly to the line he advocates. It all goes to show, too, that the street railway business cannot be governed by any law of "averages;" rather would it appear that each particular case should be considered entirely upon its own merits.

## Cost of Steam Power.—II.[1]

By Chas. E. Emery, Ph. D.

Section 1. Previous articles of the writer on this subject dealt with the problem as it practically presented itself at the several times. The first article in 1883[2] referred particularly to results which had been obtained in a number of typical cotton mills by the use of the ordinary condensing engines in vogue at the time. A more recent article in 1893[3] discussed the question of the cost of steam power in 500 horse power units or multiples of the same developed in different kinds of engines, including the more modern triple compound engines. The first paper was based on actual conditions, the second on assumed conditions, the best experimental results being considered, but afterward modified by judgment so as to give a final result which would approximate the conditions of ordinary average working. In a later and more general article published in 1895[4] the method employed to increase experimental results to an approximately practical basis was outlined, but otherwise the inquiry was extended little or no further than before.

§ 2. In connection with the proposed supply of power in large units from Niagara Falls and other undertakings of a similar character, the question naturally arises: What would be the cost of steam power if also supplied in large units and generated with modern machinery of the most approved type? The question would be a simple one if it involved only the amount of coal consumed at a definite price, and the labor required to handle the coal and attend to the machinery. It is very common to compare the value of two engines simply by the relative amount of coal consumed, assuming that other costs incident to the development of the same power will be the same in all cases. Even if the assumption be substantially correct it has a more important bearing on the result than appears at first sight. The cost of coal is, for ordinary engines of moderate size, only about one-third of the total cost of steam power, so, if the other costs remain nearly constant, moderate savings in the cost of coal will not proportionally decrease the cost of the power.

§ 3. In large plants operated nearly at full capacity, the best types of steam machinery can be profitably employed, the cost of superintendence will be reduced and the cost of labor required for operation materially decreased. The decrease in labor depends largely on the size of steam unit it is found practicable to employ. Triple compound engines of 10,000 to 15,000 horse power each are used quite successfully in our large ocean steamers, but it is considered that these units are altogether too large for the problem we are considering.

§ 4. Any supply of power must be adapted to the nature of the demand, which for most industrial operations is variable, and it is desirable to make the steam units of such size that one or more of the same can be grouped together to carry the load at any time without either overloading or greatly underloading either of such units. In a large plant, upon which presumably many different manufactories depend for power, there should be a spare unit which can be used in case of accident and ordinarily employed in regular turn so that all the machinery can be kept in repair.

§ 5. It will thus be seen that the size of the units is limited by the conditions stated. If 20,000 horse power as a maximum were to be delivered, two units of 10,000 horse power each would do the work, but evidently the spare engine would require also to be 10,000 horse power, and this would involve too large an amount of capital in spare machinery. At Niagara Falls four connected turbines and dynamos of 5,000 horse power each are being erected in a preliminary plant so that only 15,000 horse power maximum can be delivered if the principles above outlined are strictly carried out, though evidently contracts can be drawn to provide that the power may be stopped in case of accident, the same as in a private establishment, and thereby all the wheels and engines put in service at the same time, but it is probable that one unit will be practically kept in reserve and more units added as the demand warrants. With steam power there would be some advantages for a 20,000 horse power plant in adopting a unit of 2,500 horse power, on which basis with one spare unit of this size there would be nine such units in all. There is an advantage in having all the engines alike, as the parts required for repairs are then duplicates of each other, the units can be more suitably arranged in the building and the labor better distributed. When it could be done without too much detail, it would be desirable to couple together several engines of 2,500 horse power each, so that they would be capable also of independent operation. Another method would be to disregard absolute uniformity when so much power is to be delivered and have several duplicates of two different units, say one of 2,500 horse power and another of 5,000 horse power, which would either require the size of the spare engine to be increased, or that the other engines be slightly overworked in case of accident. For simplicity, however, all the costs will be assumed alike with either arrangement.

§ 6. The average cost per horse power when the load is variable is considerably greater than if the power be furnished continuously. Coal is wasted in building up the fires and in caring for them when not required; all supplies are increased from the necessity of starting new after every stoppage, and there is an important loss due to the interruption of the regular hours of labor. A sufficient force must be kept on hand at all times to provide for any demand and the watches of the men arranged in some practical way so as to proportion the labor to the work to be done as nearly as possible.

§ 7. It is desirable at the outset, however, to ascertain what steam power will cost under the most advantageous conditions as to demand, and we therefore submit a preliminary estimate based on the assumption that 20,000 horse power can be sold for every hour in the year. The details of the estimate are discussed afterward.

§ 8. TABLE I.

SHOWING COST OF STEAM POWER ON BASIS OF GENERATING 20,000 HORSE POWER CONTINUOUSLY EVERY DAY IN THE YEAR.

| | Yearly cost of coal for 20,000 net horse power operated continuously every hour in the year, based on a consumption of 1.25 pounds of coal per indicated horse power per hour, § 10. Cost of coal assumed at one mill per pound, or $2.24 per ton, | | Per cent of Total Cost. |
|---|---|---|---|
| 1. | § 12. Engine efficiency assumed at 92.3 per cent, § 11 | $237,250 | 43.4 |
| 2. | Estimated cost of labor, § 13 | 60,444 | 11 1 |
| 3. | Estimated cost of supplies and regular repairs, § 14 | 105,120 | 19 2 |
| 4. | Estimated interest, insurance, taxes and cost of renewals, § 15-16 | 144.000 | 26.3 |
| 5. | Total | $546,814 | 100.0 |
| | Which divided by 20,000 gives the following: | | |
| 6. | Cost of steam power per horse power per year, on basis of 20,000 horse power delivered every hour in the year | $27 34 | |
| 7. | Cost of steam power per horse power per year on above basis, if 5 per cent. of the original cost of plant, § 16, be charged for dividends, and $1 per horse power added for general business expenses, § 18 | 31.94 | |
| 8 | Cost of steam power per horse power per year on above basis, if 10 per cent. of the original cost of plants, § 16, be charged for dividends, and $1 per horse power added for general business expenses, § 19 | 35.54 | |

§ 9. This cost is, for reasons which will be discussed later, lower than it is probable any plant can be operated under commercial conditions. This price is somewhat higher than those given in the papers previously mentioned, simply because operation is supposed to be continued every hour in the year.

§ 10. The cost of coal above outlined is derived as follows: The best triple compound engines have developed a horse power for a little less than 12 pounds of water per horse power per hour, and boilers have been constructed which at actual pressure from actual temperature offered evaporated 10 pounds of water per pound of first quality coal. Both these results are under experimental conditions, but we must assume that in a large plant like this all details will be so well attended to that fair experimental results may be obtained all the time. We, therefore, assume that the power will be produced regularly for 1¼ pounds of coal per indicated horse power per hour which would be obtained with engines requiring 12½ pounds of feed water per horse power, if the boilers evaporated 10 pounds of water per pound of coal, or if the boilers evaporated 9.6 pounds of water per pound of coal and the engines only required 12 pounds of water per horse power per hour.

§ 11. For permanent work of the kind assumed, engines of comparatively slow speed should be selected and, although some of the work might be directly connected, part of it at least would necessarily be operated by some method of transmission. The frictional losses of the engines and the more important features of transmission to the work done have been assumed at 7.69 per cent., so that the amount of coal per indicated horse power above assumed must be increased by one-twelfth to give the coal per net horse power.

§ 12. The cost of coal per ton varies greatly in different parts of the country. The actual cost of mining bituminous coal is as low as 25 cents per ton in some locations and the coal can be delivered on the cars at a good profit at 50 cents per ton. At deep mines the cost of mining is greater, but in all cases the principal cost of coal is the transportation, which has been reduced from time to time by increasing the size of the coal cars and the weight of the train and by reducing the grade in the direction of traffic, until it is credibly stated that coal can be hauled on the main trunk lines at a profit for one-half cent per ton per mile, thus adding only 50 cents per ton for each 100 miles of haul. The lateral roads with undulating grades cannot haul coal at as low a rate as this. There is, moreover, to be added the general selling expenses, so it has been assumed that along the lakes, although comparatively near coal mines, the best quality of coal will cost but little over $2 per ton if purchased in large quantities, though this price must be increased on the seaboard fully 75 cents, and for ordinary consumers, of course, much more. The price upon which comparison has been made is 1 mill per pound or $2.24 per ton, to include the cost of delivery directly in front of the boilers. The cost in line 1 of the table, § 8, is derived simply by multiplying the net power, 20,000, by 1¼, the coal per indicated horse power, adding 1.12 to allow for friction, and multiplying the result by 8,760, the number of hours in the year, and $0.001, the price per pound. The next item, that of labor, is made up as follows:

§ 13. Without attempting to arrange watches, it is assumed that on the average there would be required in such a station at all times:

| | |
|---|---|
| One attendant for each 2,500 horse power engine, or eight men in all, at 25 cents per hour | $2 00 |
| Fourteen firemen and three additional men at the same pay to care for pumps, etc., and to keep the premises clean; total, 17 men at 20 cents per hour | 3 40 |
| Total cost of labor per hour | $ 5 40 |

There would also be required a chief engineer, three assistant engineers and some clerical help, which, under the head of superintendence, would cost, say, $13,140 per year, or $1.50 per hour, making a total of $6.90 per hour. The total cost for labor and superintendence for one year of 365 days, or 8,760 hours, at $6.90, is $60,444, as given in line 2 of § 8.

§ 14. The cost of supplies and repairs in connection with the boilers and large condensing engines in the cotton mills of Fall River proved, upon investigation several years ago, to be approximately 8.10 of a mill per horse power per hour. With the hope that this cost can be reduced in an immense plant of this kind the quantity in line 3 has been extended on the basis that the cost will be only 0.6 mill.

20,000 horse power × 8,760 hours × $0.0006 = $105,120, as written in line 3 of § 8.

§ 15. The above estimates only provide for regular repairs. Independent of this a certain percentage of the first cost should be put at interest every year to provide for renewals of the machinery, and provision made also for paying taxes and insurance. Calling these three 5 per cent. of the cost, and considering that a company which can build so large a plant can possibly borrow money at 5 per cent., 10 per cent. of the total cost will be required for these several items.

§ 16. The total cost of such a plant cannot be determined accurately in advance. The present prices for steam machinery are very low, and it might be possible to buy engines of the best type with necessary boilers, ready for erection for $30 per horse power. To this price, however, must be added the cost of the land upon which the plant is to be erected, the cost of foundations, of erection, of the buildings, of the chimney, the pipe connections, the general means of transmission, and the multitude of minor details required for fitting up such a place ready for use. The probable cost has been fixed at $64 per horse power, and as at least one-eighth surplus power will be put in the station, there will be required a steam plant of 22,500 horse power, which at $64 will cost complete $1,440,000, 10 per cent. of which, as required above, is written in line 4, § 8.

§ 17. Referring to line 6, § 8, we find that the "Cost of steam power per horse power per year on the basis of 20,000 horse power delivered every hour in the year" is $27.34. The price at which this power can be sold to consumers will depend upon the way the company furnishing the power is organized. The interest on the cost is already provided for in line 4, so the net cost given, viz., $27.34, would be that chargeable to power if the same company that built the works used the power, or if an association of individuals should build the plant and simply charge themselves with its cost.

§ 18. If, however, a private company with ample means should build the plant on a cash basis and wish to sell power and realize a return of 5 per cent. on first cost independent of interest on the money invested, the modified cost would be $27.34 plus 5 per cent. of $72 (§ 16), viz., $3.60, to which should be added, say, $1 per horse power for general business expenses, making the total charge $31.94 shown in line 7, § 8, the same method being used in reference to similar lines in tables II. and III.

§ 19. If, however, the promoters desired 10 per cent. profit on original cost or a proportionally less percentage on stocks and bonds issued in excess of first cost, the modified cost per horse power per year would be $27.34 plus 10 per cent. of $72 (§ 16), viz., $7.20, to which adding $1 per horse power as before for general expenses, gives as the total charge under these conditions $35.54, shown in line 8, § 8, the method applying to tables II. and III. as above explained.

§ 20. We are now prepared to ascertain the variations in result which would be produced if the power were considered variable. For this purpose let us assume there will be sold:

| | | Daily h. p. hours. |
|---|---|---|
| 1. | 20,000 horse power 10 hours per day | 200 000 |
| 2. | 12 000 horse power 10 hours per day | 120,000 |
| 3. | 5,000 horse power 4 hours per day | 20,000 |
| 4. | Total daily horse power hours | 340,000 |

which would probably be required on, say, 309 working days in the year.

| | | |
|---|---|---|
| 5. | Total horse power hours, 309 days | 105,060,000 |
| | Then, if 5,000 horse power were required for the remaining 56 holidays in the year: | |
| 6. | Total horse power hours, 56 days of 24 hours, 5,000 horse power | 6,720,000 |
| 7. | Total horse power hours per year | 111,780,000 |
| | Average horse power per hour during the year: | |
| 8. | Previous result ÷ 8760 = | 12,760 h. p. |

The average horse power is therefore 63.80 per cent. of the maximum.

This percentage is frequently termed the "power factor," and is rather higher than has been found in practical cases heretofore. An estimate of the cost on this basis will be given in advance as before and explained afterward.

§ 21. TABLE II.

SHOWING THE COST OF STEAM POWER ON BASIS OF GENERATING 20,000 HORSE POWER MAXIMUM AND AN AVERAGE OF 12,760 HORSE POWER FOR EVERY DAY IN THE YEAR.

| | | | Per cent. of total cost. |
|---|---|---|---|
| 1 | Yearly cost of coal, § 22 | $157,644 | 37.3 |
| 2. | Estimated cost of labor, § 23 | 47,652 | 11.3 |
| 3. | Estimated cost of supplies and regular repairs, § 25 | 73,584 | 17.4 |
| 4. | Estimated interest, insurance, taxes and cost of renewals, § 26 | 144,000 | 34.0 |
| 5. | Total | $422,880 | 100 0 |
| | Which divided by 12,760, the average horse power, § 20 gives the following: | | |
| 6. | Cost of steam power per horse power per year on basis of delivering 20,000 horse power maximum and an average of 12,760 horse power for every day in the year | | $33.14 |
| 7. | Cost of steam power per horse power per year on above basis if 5 per cent. of the original cost of plant be charged for dividends and $1 per horse power added for general expenses, § 18, 33.14 + 3 60 + 1.00 = | | 37.74 |
| 8 | Cost of steam power per horse power per year on above basis if 10 per cent. of the original cost of plant be charged for dividends and $1 per horse power added for general expenses, § 19, 33 14 + 7.20 + 1 00 = | | $41.34 |

§ 22. The cost of coal is made up as follows: By reference to § 20 it will be seen that 15,000 horse power of boilers out of 20,000 must be shut down daily for periods varying with the demand, and it is considered that it will require an amount of coal equal at least to the average consumption for one hour during regular operation, to maintain banked fires, overcome radiation, and bring the fires to average working condition when they are again put in operation. The total daily horse power hours in line 4, § 20, is therefore increased 15,000 and multiplied by 309; the horse power hours for the 56 holidays, line 6, are then added to the

1. Read at the twelfth general meeting of the American Institute of Electrical Engineers, Niagara Falls, N. Y., June 26, 1895.
2. Transactions American Society Civil Engineers, vol. xii, p. 425, November, 1883.
3. Transactions American Institute Electrical Engineers, vol. x, p. 119, March, 1893.
4. *Engineering Magazine*, vol. viii., p 796, February, 1895.

same; the sum multiplied by 1.25 pounds of coal per horse power and by 1 mill per pound and one-twelfth added to the whole for friction, which gives the result written in line 1, § 21.

§ 23. The labor cannot be distributed accurately until the variations of loading are developed practically. On any definite basis, such as is assumed in § 20, the watches could be arranged so tha there would be little loss of time, but in practice there would be a variation of load at the same hour on different days. For instance, with the electric lighting part of the load, the demand would vary with the weather; with the cable or electric railroad portion of the load the demand would be greater on particular days and seasons, and vary also somewhat with the weather, so to be provided for unexpected demands there must be a surplus of labor. Such surplus will be assumed at 20 per cent. for the 14 hours of reduced power per working day, shown in § 20, lines 2 and 3; equivalent to labor for 28,000 horse power hours per day, or 8,652,000 horse power hours for 309 days. Adding only 10 per cent. for 56 holidays gives 6,720,000×1.1=7,392,000 horse power hours. Adding both to the total horse power hours, § 20, viz , 111,780,000, gives a total for the year of 127,824,000 horse power hours, which at $0.00027 per horse power easily derived from § 13 gives:

| | |
|---|---|
| Cost of labor per year | $34,512 |
| Cost of superintendence per year, from § 13 | 13,140 |
| Total for labor and superintendence per year as written in line 2, Table II., § 21 | $47,652 |

§ 24. The cost of labor and superintendence above is 100×$47,652÷60,444=78.83 per cent. of that required for full operation throughout the year shown in § 8, although the average power developed is only 63.80 per cent., § 20.

§ 25. The cost of supplies and regular repairs, line 3, will be somewhat greater proportionally than for continuous operation, and is estimated to be 70 per cent. of the similar costs given in § 8, $105,120×0.70=$73,584, which is written in line 3, § 21.

§ 26. Evidently the interest, insurance and taxes given in line 4, § 8, are not modified, and the percentage allowed for renewals is so small as not to materially affect the result, so the amount given in line 4, § 8, is repeated in same line of Table II.

§ 27. The presentation in Table II. will give a fair idea of the prices it would be necessary to secure on installing a large steam plant to furnish power in various quantities to consumers on the premises, or to apparatus for transmitting power to the same, the costs of which transmission are not included. The costs at which the power can be sold under certain specified conditions, as stated in lines 7 and 8, § 21, are the only features that directly interest consumers of power.

§ 28. A large proportion of the power in manufacturing establishments is used only 10 hours per day, so this investigation would not be complete if it did not include the presentation of the cost of steam power generated with large units for 10 hours per day. Such an estimate is made in Table III., the explanation of the items being given afterward as heretofore.

§ 29.

TABLE III.

SHOWING THE COST OF STEAM POWER ON THE BASIS OF GENERATING 20,000 HORSE POWER CONTINUOUSLY FOR 10 HOURS PER DAY FOR 309 DAYS IN THE YEAR.

| | | | Per cent. of total cost. |
|---|---|---|---|
| 1. | Yearly cost of coal, § 30 | $92,056 | 30 6 |
| 2. | Estimated cost of labor, § 14 | 27,198 | 9.1 |
| 3. | Estimated cost of supplies and regular repairs, § 32 | 37,080 | 12.3 |
| 4. | Estimated interest, insurance, taxes, and cost of renewal, § 33 | 144,000 | 48.0 |
| 5. | Total which divided by 20,000 gives the following: | $300,334 | 100 0 |
| 6. | Cost of steam power per horse power per year on the basis of delivering 20,000 horse power continuously for 10 hours per day for 309 days in the year | 15 17 | |
| 7 | Cost of steam power per horse power per year on above basis if 5 per cent. of the original cost of plant be charged for dividends and $0.75 per horse power added for general business expenses, § 18 ....15.17+3.60= $18. 7. 18 77+. 75= | 19 52 | |
| 8. | Cost of steam power per horse power per year on above basis if 10 per cent. of the original cost of plant be charged for dividends, and $0.75 per horse power added for general business expenses, § 19 .15.17+7.20=22.37; 22.37+ 75 | 23 12 | |

§ 30. The yearly cost of coal, line 1, above, is obtained by computing the coal for 11 hours per day, for reasons explained in § 22 and making the calculations explained in the latter part of § 12 for 390+11=3,399 hours in the year.

§ 31. The labor would be occupied 309 working days, and, say, one-half the holidays, § 20. The cost of labor for 337 days, 10 hours, or 3,370 hours, at $5.40 per hour, § 13, =$18,198. Two assistant engineers could be dispensed with, compared with § 13, thus reducing the cost of superintendence to, say, $9,000 per year. The second of these two quantities is written in line 2 of Table III.

§ 32. The cost of supplies and repairs is estimated at the rate of 0.6 mill per horse power hour as per § 14, 20,000×3,090×$0.0006=$38,080, as written in line 3, Table III.

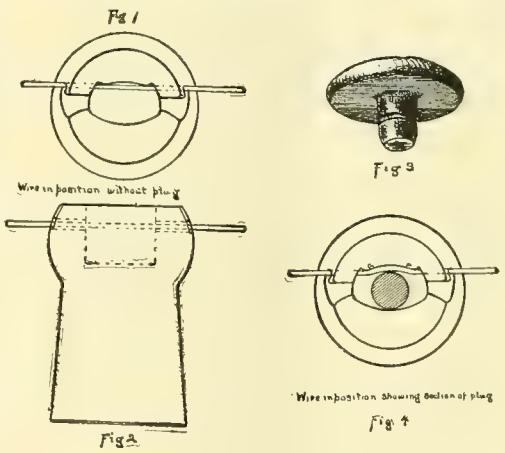
§ 33. The amount written in line 4, Table III., is the same as for the two other cases. The cost of renewals should apparently be reduced as the machinery operates less hours, but the percentage allowed for renewals is very small and should be increased for the other cases rather than reduced for this. Moreover renewals are made more frequently on account of new discoveries or changes in business than from the actual wearing out of the apparatus.

§ 34. The prices given in the lines 6, 7 and 8 of Table III., § 29, will best compare with those carried familiarly in the mind. The minimum cost derivable from the paper in *Transactions* for 1893, above referred to, is for coal at $2.24 per ton and 10 hours per day, $22.31 per horse power per year. This should be compared with $18.77 in line 7 of Table III., as the previous calculations provided for 10 per cent. interest and dividends, as is provided in lines 4 and 7 jointly in Table III., but not for general business expenses. The difference is $3.54 per horse power, corresponding to a saving of 15.87 per cent. by generating the power on the larger scale.

§ 35. The quantities in the paper above mentioned were augmented here and there so as by judgment to try and approximate the various losses incident to average practice, though insufficiently to show the results of such practice in some locations. The prices herein given are as low as it would be safe to expect with very careful management of a very large plant. The comparatively small difference in result is due to the influence of the constant cost shown in line 4 of the several tables. It forms 26.4 per cent. of the total cost for 20,000 horse power every hour in the year, Table I., § 8; 34 per cent. for variable power, 20,000 horse power maximum, 12,760 horse power average day and night, and rises to 48 per cent. for 20,000 horse power during 10 hours of the ordinary working days in a year. The cost of coal is respectively 43.4 per cent., 37.3 per cent. and 30.6 per cent. of the total cost for the same three conditions. The fixed charges also increase greatly the cost of water power, as the writer has had occasion to call to the attention of parties engaged in these large hydraulic enterprises.

§ 36. It should be borne in mind that if water power or power derived from water be sold on a 24 hour basis, but can only be utilized during 10 hours per day, the cost of the water power direct or derived should be compared, not with the cost of steam power on a 24 hour basis in Tables I. or II., but with that of steam power on a 10 hour basis in Table III.

§ 37. It should also be borne in mind that all these estimates provide for fixed expenses, such as interest, insurance, taxes and cost of renewal, and that in comparing the prices above given with the cost of water power, similar fixed expenses should be added to the price of such power, based on the cost to consumer of installing the water power or the mechanism through which the power is derived. For instance manufacturers located on the canals of large water power companies necessarily build their own head and tail races and wheel-pits and install the gates, screens, turbines and means of transmission for utilizing the power. This when well done in many locations costs as much as to install a steam plant, so the fixed annual charges for this item alone would be $5 to $7 per horse power, which together with cost of labor and supplies, must be added to the cost to be paid for the water power in order to compare with the cost of steam power as presented in the tables of the writer.




NEW INSULATOR.

§ 38. When power is electrically transmitted, the consumer is generally required to pay for the electric motor, the general means of transmission therefrom, and some incidentals. The cost of this work, together with the portion of the building and even of the real estate occupied should be considered in the same way as has been done above, and at least 10 per cent. of such cost, together with actual costs of labor and supplies, added to the tendered price of net power delivered, in order to compare the cost of power obtained in this way with the cost of steam power shown in the various papers of the writer, which are written on the basis that a manufacturer should receive a profit on the money expended in plant as well as that expended in his business. If interest is left out in one case it should be in the other and it is already included in the tables.

§ 39. The last column of the several tables furnishes a ready means of eliminating either of the items of cost desired. For instance, in Table III., which is on a 10 hour basis, we find in line 4 that the "estimated interest, taxes and cost of renewal" is 48 per cent. of the total cost, which cost to the parties using the power is in such table $15.17 per year, line 6. The cost of steam power per horse power per year from large units for 10 hours per day, without considering the above items, is therefore only 0 52×$15.17=$7.89, which is the cost to be compared with the price of power from an external source when the items above referred to are excluded in each case, as they are in the popular discussion of the subjects The similar cost from the estimate in the *Transactions of American Institute of Electrical Engineers*, above referred to, is $22.31, § 35, less (3.31+7.17) =22.31 — 10.48 = $11.83.

## New Insulator.

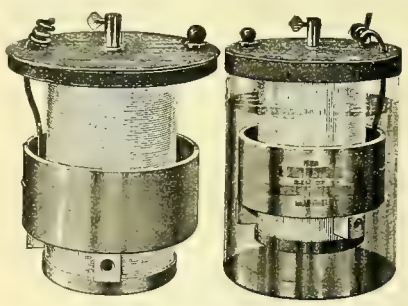
The device illustrated and described herewith is a new form of insulator, for which a patent has been granted to Albert Vickers and William Dibb of Syracuse, N. Y. The insulator is designed to do away with tie-wires, and consists of a body of the present form, screwing to the pin with a top provided with a cavity shaped as shown in Figs. 1 and 2, and having two opposite recessed slots. The wire is laid in these grooves, and a plug of the same material as the insulator, shaped as shown in Fig. 3, is pushed into the cavity. This plug holds the wire against one wall of cavity, bending it very slightly, as shown in Fig. 4. It will be seen that the roller action of the plug prevents the wire from moving laterally; that the lugs keep it from flying up, and that it is therefore securely fastened. The plug cannot come out, for the pressure of the wire against the slight groove in it holds it to its place securely enough, as there is no strain on it tending to force it out. The advantage of this form of insulator is that the wire rests on nothing but smooth surfaces of glass or porcelain, so all chance of abrasion or mechanical injury is prevented. It is held to the insulator more securely than even a tie can hold it, and all the corrosion scratching due to tie-wires is entirely done away with. It is evident, therefore, that broken wires and crossed lines will be reduced to a minimum on lines where this insulator is used, to say nothing of the very much less time required to construct a line with them, and the securing of a perfectly uniform fastening at every insulator, and one which can be readily inspected from the ground. This insulator is being put on the market by the Noti Insulator company of Syracuse, N. Y., and is made for any size wire.

## Gordon Primary Battery.

It has been nearly three years since the Gordon battery was first known to the electrical trade, and desiring that the most careful tests and practical usages should be made of this battery, samples were placed in the hands of experts, that their efficiency and commercial worth might be known. The results having proven satisfactory, recently a company was formed, known as the Gordon–Burnham Battery company, with factory and office at 82 West Broadway, New York. The company claims that this battery will operate at a discharge rate of eight or 10 one-hundredths of an ampere six months without any attention whatever, which makes it especially adapted for railway signal, fire alarm and telephone service; and that, on account of its peculiar construction, it can perform many kinds of work not to be obtained from the gravity battery; also at a much less cost of maintenance.

One claim is that this battery has worked on the surface of the ground without interruption when the mercury has registered four degrees below zero without freezing or showing any effect of the atmosphere at that low temperature. In regard to local action it may be said that it is a non-self-consumer, the elements remaining intact until required to produce power, being free from noxious fumes and gases, and from creeping salts. It can be used in many places where other batteries would be objectionable.

In a descriptive circular issued by the Gordon–Burnham Battery company a detailed report of unusual interest is given from the New York Central & Hudson River Railroad company after a five months' trial of this battery on railway signal work, wherein statements are made which would indicate that this battery was accomplishing all the claims made for it, and would recommend itself to those concerns using batteries. The cuts show the general construction of this battery cell.



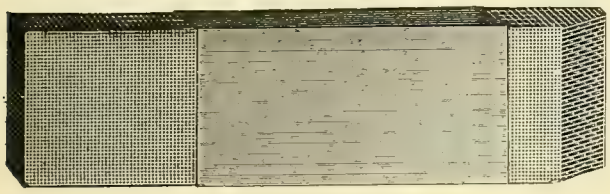
GORDON PRIMARY BATTERY.

## Keily–Meagher.

It is with pleasure and satisfaction that the announcement is made that another member of the staff of the WESTERN ELECTRICIAN has taken to himself a partner for life. W. E. Keily and Miss Catharine Meagher were married on September 26th at the home of the bride, 6631 Drexel avenue, Chicago. The ceremony was private, only the families of the contracting parties being present, but there were many messages of good will from friends who had learned of the arrangement. The bride is an estimable lady of this city and the groom needs no introduction to the electrical fraternity, among whom his ability is recognized and his friendship highly prized. An expression of the hearty good will of Mr. Keily's associates on the WESTERN ELECTRICIAN is scarcely necessary, yet they cannot refrain at this time from giving assurance of their interest and their hope that the young couple may live long and prosper.

## Ventilated Dynamo Brush.

One of the most recent and marked improvements is the Cherry-Younglove ventilated dynamo brush, manufactured by Younglove & Gere of Syracuse. This brush has been manufactured since 1892, and it is now used in every part of the United States, as well as in foreign countries. Its special advantages arise from its superior construction on ventilating principles, preventing it becoming gummed or clogged. It adds to the durability and usefulness of electric commutators, saving many times its cost thereby. It is pronounced the best of all dynamo brushes by leading experts. It is perfectly flexible, there being no cutting of the commutator, no harsh noise, no sparking or fusing at the point of contact. The brush is suitable for all incandescent and plating dynamos, alternating generators and exciters, electric railway generators and stationary motors. Trial



VENTILATED DYNAMO BRUSH.

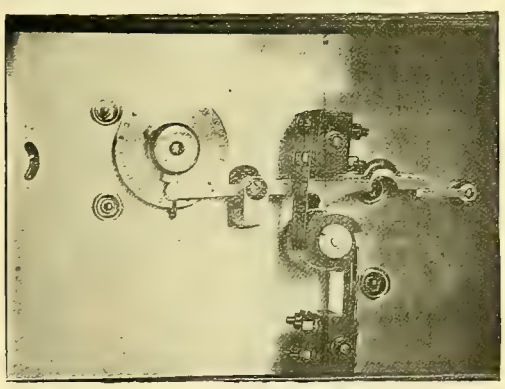
samples are forwarded to reliable companies at any point. Estimates and price lists are also furnished on application, or by mail, by the home office, Syracuse, N. Y.

## American Institute of Electrical Engineers.

At the monthly meeting of the council of the American Institute of Electrical Engineers, September 25th, the following associate members were elected:

Sydney B. Austin, Sidney, N. Y.; George H. Blaxter, Pittsburg, Pa.; Elmer E. Boyer, Lynn, Mass.; Byron T. Burt, Charleston, S. C.; Henry S. Carhart, Ann Arbor, Mich.; John B. Cornell, Hamilton, O.; Maurice Coster, Chicago, Ill.; David Francis Crawford, Fort Wayne, Ind.; Philip Dawson, London, Eng.; Lewis Degen, Rio de Janeiro, Brazil; Will Knox Dunlap, Pittsburg, Pa.; Thomas C. Frenyear, Gloversville, N. Y.; Carl Harold Hakonson, Schenectady, N. Y.; Russell B. Harrison, Terre Haute, Ind.; Robert R. Harvey, Wilkesbarre, Pa.; Charles E. Hewitt, Hanover, N. H.; Charles R. Huntley, Buffalo, N. Y.; D. W. Irvine, Chambersburg, Pa.; W. Wallace Ker, Jersey City, N. J.; Paul M. Lincoln, Niagara Falls, N. Y.; Robert Bruce Mann, Milwaukee, Wis.; Josiah L. Merrill, Schenectady, N. Y.; Charles H. Merz, Newcastle-on-Tyne, England; James Mitchell, Rio de Janeiro, Brazil; Edgar L. Morley, New York, N. Y.; Evan Parry, London, S. E., Eng.; Andrew Pinkerton, Apollo, Pa.; Percy Howard Powell, Hempstead, N. Y.; Dwight Parker Robinson, Boston, Mass.; David B. Rushmore, Plainfield, N. J.; John F. Skirrow, Brooklyn, N. Y.; Henry G. Stott, Buffalo, N. Y.; Gustav Adolph Wiese, Alameda, Cal.; Chester P. Wilson, Philadelphia, Pa.

Prof. F. A. C. Perrine of Stanford University, Palo Alto, was appointed local secretary for San Francisco and vicinity. In order to provide a more central location for the meetings of western members at Chicago, the report of the



AUTOMATIC ELECTRIC TIME SWITCH.

committee appointed at the Niagara Falls meeting to consider this question was taken up, and the use of the rooms of the Western Society of Engineers in the Monadnock building was authorized for the present season, as recommended by the committee. Through the courtesy of the Armour Institute, meetings requiring the use of apparatus will be held there as heretofore. The meeting of the institute in the evening was held at the Hoffman House, at which a paper by C. S. Bradley on "Phasing Transformers" was read by the author, and the working of the described apparatus shown. Eighty members were present.

The commissioners of Noble county, Ind., have granted a franchise to capitalists to construct an electric road which will connect the towns of Columbia City, Cherubusco, Avilla, Heda, Syracuse, Cromwell, Albion, Wilmont and Swan.

# COMMUNICATION.

## The Telephone Agreement.

*To the Editor of the* WESTERN ELECTRICIAN:

Referring to an accusation through a Boston paper to the effect that the movement to present the illegal combination between the Bell company and the Western Union, Western Electric, American Telephone & Telegraph company and the licensees of the Bell company has for its effect the disturbance of the stock of the Bell company, the writer desires to say that this is an absolute falsehood, without any possible basis. The writer does not care what the price of Bell tock is.

The Bell company and the parties to this most monstrous compact have through specific arrangement in writing agreed to invoke the laws and flaunted its patent papers in nearly every court in the land to sustain a monopoly.

The writer's motive was inspired principally by a belief that this contract in writing specifically violated not only the Federal laws but the statutes of nearly every state; that in conformity with this contract, in spirit and will, a monopoly was being maintained unlawfully; that this unlawful monopoly was oppressive in more than one way to the writer and those with whom he had interests; that the rate cutting in vogue where competition was started was in pursuance of clause 5, taken together with clause 2 of article 2 of the agreement, to stifle competition, and his position in the telephone business required his individual action.

Data is being prepared to properly present in the form of a petition; and as the Bell company seems to love law so well, possibly it may have misinterpreted its meaning as affecting it. Very truly. J. E. KEELYN.

## John L. Martin Arrested.

John L. Martin was arrested in New York on September 24th while endeavoring to secure a number of blank checks which he had ordered printed under the name of J. B. Moore. He had represented himself as "cashier of the Merchants' and Manufacturers' Bank of Chicago," the dispatches say, and when it was learned that no such concern was known to the bankers of this city he was suspected of being a sharper. When arrested, Martin admitted that he had been practicing fraud upon his old friends, substantiating in every particular the statement published in the WESTERN ELECTRICIAN warning the electrical fraternity against him. The arrest created a sensation in this city among the bankers as well as the electrical men.

## Automatic Electric Time Switch.

This instrument is designed for use in places where it is desired to automatically light and extinguish incandescent lamps at certain specified times. It is adapted for use in stores to light up the lamps in show-windows on Sunday evenings and holidays; in apartment houses, to light the lamps in the halls on the approach of darkness and extinguish them at the proper time in the evening, and in all other places where it is desired to light or extinguish lamps, or turn on or turn off at more or less frequent intervals, or turn on or turn off the current for any purpose. The instrument is provided with an accurate eight-day clock movement and time dial to show the exact time of day and to operate the switch. The switch is double-poled, very powerful in action, and will control any number of lights or quantity of current desired. In the cut the time dial is shown on the left. In front of the dial are two brass wheels, or cams, with a single projecting tooth on each, which control the action of the switch; one cam turns the current on and the other turns it off. The cams can be turned around on the dial so as to set the teeth opposite any hour desired, and when so set and secured by means of a set nut, they will turn with the dial and at the designated time press on the two levers, also shown in the engraving. When the first tooth is brought around and pressed against the lever opposite to it and that lever is depressed it releases the cylinder of the switch, allowing it to make one-quarter of a revolution and closing the circuit. The switch then remains stationary until the second tooth is carried around and presses against the other lever. That lever is then depressed and allows the cylinder to turn another quarter of a revolution, thus turning off the current. The circuit then remains open until the first tooth is brought around again, when the operation is repeated. The switch can be made to operate at more frequent intervals by placing additional teeth on the cams. The instrument was originally designed for a special use, but its utility and value for many purposes were immediately recognized, and there is undoubtedly an extensive field of usefulness awaiting it. It is manufactured by Jerome Redding & Co., 48 Hanover street, Boston, Mass.

The village of Blue Earth City, Minn., is considering the issuing of $1,000 bonds to purchase the electric light plant.

# CORRESPONDENCE.

## New York Notes.

NEW YORK, September 28.—More interest is manifested by street railway men of this part of the country in the Montreal convention than is generally shown in these meetings. This is due to the fact that New Yorkers are beginning to realize that they are behind the times, and that in order to look alive they will have to learn what other cities are doing in the way of improved surface transportation. We hear every day of the privileges our neighbors are enjoying and we are beginning to wonder why we cannot have trolley cars instead of slow-going horse cars and why we cannot enjoy trolley parties like the city across the bridge. In Brooklyn the trolley parties have already attained the popularity which this form of entertainment enjoys in Philadelphia, Paterson, N. J., and other towns in which it has been introduced. The cost is $20 for each car, and the company furnishes ice cream tickets. The cars are larger than the ordinary type, decorated with flags and streamers, and gorgeously lighted with red, white and blue electric lamps clustered at the ends and sides. The $20 entitles the party to the use of the car for six hours, and, as it will hold fifty or sixty passengers, the expense per head is not greater than the cost of riding for the same length of time over different trolley lines, paying separate fares on each of 5 cents. Parties have the privilege of going at their sweet will wherever trolley lines lead, eating the ice cream as you whiz along, or they may stop at some suburban resort or road house to eat it while the trolley car waits outside. In Philadelphia, where trolley parties have reached a high stage of development, they have dining cars to attach to the trolley party cars, so that a more substantial supper than ice cream may be served. This winter they are going to have trolley theater parties in Brooklyn. To say nothing of the fun of the straw-ride order, trolley parties have proved a fine way of cooling off on the recent hot nights. Some parties take a band of music along with them, but the practice at present is looked upon as a trifle dubious. In a few cases a compromise has been made by substituting an Italian organ grinder for the German band.

Several weeks ago the Southern boulevard branch of the Union Railroad company was put in operation, and the company met with unexpected opposition from the New Haven Railroad company, which refused to allow the trolley cars to cross its tracks at the junction near One Hundred and Forty-third street, and blocked the way with an engine and an old passenger car. The fight began with the question as to which company should erect guard gates at the crossing. Back of this simple question is the greater one that the company erecting the gates will have to assume the greater part of the responsibility for any accidents which may happen at the junction. The fight is still on, and the locomotive and car and men to man the engine are still on duty, although it costs the New Haven company $50 a day to keep them there, and the sum total of expense has already reached the comfortable sum of $1,700.

There was trouble last week when, through a hitch with the Long Island Railroad company, the opening of the Sheepshead Bay branch of the Nassau electric railroad had to be deferred a little longer. The Nassau company's new trolley line runs from Broadway to Marcy avenue, to Fulton street, to Nostrand avenue, to Bergen street, to Rogers avenue, to Church avenue, and thence through Ocean avenue to Sheepshead Bay. The trolley line crosses the Manhattan Beach railroad tracks in Ocean avenue about three miles from the bay, and it is over this crossing that the trouble has occurred. A force of 40 men had started to lay a copper electric cable under the tracks, when a switchman in a nearby tower informed the general office of the Long Island railroad. In a few minutes a locomotive attached to a wrecking train came bowling down the track, and there after ran back and forth across Ocean avenue, where the Nassau road's employes were trying to work. After the intention of the steam road's officials became manifest the electric road's force withdrew. President Flynn, when asked about the muddle, said:

We have an agreement with the Long Island Railroad company, signed by Mr. Corbin, giving us the right to cross his tracks. The terms of the agreement provide that we shall erect a watch tower for a switchman at the crossings, put in "derailing" switches, and, in fact, take every possible precaution against accident. Heretofore, where we have crossed the track of the Long Island railroad, we have had the track ready to be operated over a few days or perhaps two weeks before we have had our switches or towerhouse ready. Mr. Corbin has made no objection to our crossing and placing two or three flagmen to guard against accident. As I understand it, that is the cause of our being stopped. He intends to make the Nassau company live up to the letter of its agreement, because this line to Manhattan Beach comes more directly in competition with the Long Island railroad than any others that we have opened. We have always permitted the Long Island Railroad company to put in the crossing, and intended to do so this time. We were not trying to lay the track, but merely the heavy

copper cable which it is necessary to have at a railroad crossing, so as to prevent the leaking of the current into the tracks of the other railroad. I think as soon as we can get at Mr. Corbin that the whole matter will be straightened out.

The United States & Hayti Cable company has chartered the cable steamer Mackay-Bennett for the purpose of laying the first section of a submarine cable to connect New York direct with Hayti, West Indies. On September 23d the Mackay-Bennett submerged the heavy shore end cable, about 10 knots long. The cable terminates near the landing place of the Commercial company's cables at Coney Island.

Much interest is manifested here in the announcement that ground was broken at 1:35 o'clock this afternoon on the bank of the Erie canal in Tonawanda for the erection of a trolley line to test the feasibility of the application of electricity to canalboat towing. The accounts of the proceedings say that Frank W. Hawley, vice-president of the Cataract General Electric company, turned the first sod. The test is likely to be made Saturday, October 12th. If the motor to be used demonstrates merit and inspires confidence it will be adopted for generel use on the canals and the line extended through the state, a fact which may be a material factor in solving electrical transmission for long distances. Deputy Superintendent of Public Works Lay represented the state to-day and was delighted at the bright prospects of success. W. Caryl Ely prophesied it would divert an enormous business into canal channels and that all cities and towns along the canal would be benefited. The boatmen present look forward to the test with great eagerness.

William F. Carleton of the firm of Carleton & Kissam, Boston and New York, died last week at the Hot Springs Hotel, Yellow Stone Park. Mr. Carleton was the pioneer in the street car advertising business, which he had carried on for 20 years. At the time he started in the advertising field he was in the employ of the Second Avenue Railway company of this city. He built up an immense business, gradually obtaining control of the advertising in all the large street car lines in the country. His list embraced the systems of New York, Chicago, Cincinnati, Kansas City and San Francisco, with that of the West End in Boston, and smaller lines in suburban towns. He was born in Lynn, Mass., in 1847. W. F. O.

## Milwaukee, Wis.

MILWAUKEE, September 28.—The fight that has resulted from the effort of ex-Congressman Lawrence McGann and his associates to get a franchise for a street railway in opposition to the monopoly of the Milwaukee Street Railway company, is still in progress. The Common Council committee on railroads, before which the matter is pending at present, held another meeting last week without arriving at any conclusion in regard to the matter. The session was mostly devoted to hearing the arguments of the Milwaukee Street Railway company's representatives and the representatives of other interests opposed to the granting of the franchise. Senator William H. Austin, who has been fighting the Milwaukee Street Railway company for several years, created considerable surprise by appearing in opposition to the McGann company. He represented Fifth street property interests, he said, and his clients would be materially injured by the granting of a franchise to build street car tracks along that thoroughfare. He was not opposed to competition, he said, but he insisted that if a franchise were granted to another company the measure should contain safeguards in the interest of the people. He declared that to him the McGann ordinance seemed to be full of holes, and that if the company passed it they would be inflicting upon the city a worse evil than the one that now exists. The ordinance, he said, did not insure the operation of a street railway by the new company, but simply authorized the construction of the road. Even the indemnity bond, which is intended to hold the city harmless, is so worded as to hold the company for damages for accidents occurring during the construction of the road, not for anything that may occur in its operation. Mr. Austin called attention to the fact that the ordinance provides for a franchise from the extreme southern to the extreme northern boundary of the city and that few down-town lines are provided for. It would have to depend upon through traffic to support it, and through traffic never made a street railway pay. The roads that carry many short-haul passengers are the ones that pay. Mr. Austin declared that the promoters of the McGann deal could have only one of two objects in view. They either want the franchise in the hope that they will be able to sell out to the Milwaukee Street Railway company, or else they were being used as a cloak by the Wisconsin Central Railroad company to get an entrance into the city. That company has long desired an entrance into the city, and at one time proposed to build a tunnel through part of the East side. What could be more probable, the speaker asked, than that the railroad company has finally adopted this means of effecting its purpose? The route selected by the McGann company—north and south—is just the kind of route that the Wisconsin Central Railroad company would be likely to select. In the East trains are being run by electricity, and it might be the idea of the Wisconsin Central to run electric trains in Milwaukee if the city would not allow it to use steam. Senator James C. Officer, who also appeared in opposition to the ordinance, said that it would be a mistake to grant a franchise upon the terms provided for in the measure under consideration. Attorney V. W. Seely said that all the ordinance did in regard to motive power was to authorize the use of electricity. Horse power or ox power could be legally used, he asserted, under the provisions of the ordinance. He stated that the provision of the ordinance prohibiting the sale of the proposed road was void because there was a state law which expressly provides for the sale of street railways. Attorney W. A. Walker informed the committee that the Milwaukee Street Railway company officers would like to be heard regarding the provision for the use of its tracks. The committee adjourned without action.

The members of the various ward committees appointed to work up public sentiment in favor of the McGann franchise held a meeting at Milwaukee garden last Wednesday evening. Speeches were made by several gentlemen who have been active in the movement and resolutions urging the Common Council to grant the franchise were adopted. The preambles of the resolutions recite the facts that the new company proposes to guarantee to sell six tickets for 25 cents, binds itself not to pool its issues with any other company, and binds itself to give its patrons the benefit of a complete transfer system, and go on to say that the sale of six tickets for 25 cents would be a saving of $1,000,000 a year to the passengers, most of whom are laboring people. The resolutions urge the railroad committee of the Common Council to report favorably upon the ordinance, and without delay, so that work may be commenced upon the construction of the road, and the people relieved of the burden imposed by the other company. The resolutions declare it the sense of the meeting that if the franchise to the McGann company were to expire at the same time that the other company's franchise were to expire, the new company should not be burdened with any conditions that would make competition unequal. Were the old company to be granted franchises along the streets that the McGann company proposes to build tracks upon, the resolutions declare, no burdensome conditions would be imposed upon it, and the resolutions call upon the council to grant a franchise containing favorable terms or not to grant a franchise at all.

The McGann people claim that a majority of the railroad committee favor their application and that a careful canvass of the council shows that at least 23 of the 36 aldermen will vote for it. However, to a man up a tree it looks as though the McGann people had a stormy course to sail.

The question of the assessment of the Edison and Badger electric light plants and franchises will be heard shortly by the Circuit Court. The city attorney has completed the return to the writ of certiorari obtained by the Milwaukee Street Railway company, and the matter is now ready for argument. It is claimed that there is no authority for the taxing of the two plants and the franchises, as they form part of the property of the Milwaukee Street Railway company and should be taxed by means of the tax upon the gross receipts of that company.

The city attorney has rendered an opinion in which he holds that the Milwaukee Street Railway company cannot be required to pave between its tracks, for the reason that no provision was made for such a proceeding in the ordinances granting franchises to the company. The franchise is a contract between the company receiving it and the people, represented by the Common Council, the city attorney holds, and it cannot be changed except by consent of both parties. To require the company to pave between its tracks would work a violation of the terms of the franchise. The provision should have been inserted in the original ordinances. While the city attorney holds that the present ordinances cannot be amended in this respect, he expresses the opinion that the Common Council can see to it that all ordinances to be granted in the future are so worded as to require that the company pave between its tracks, and an attempt to carry out this suggestion will undoubtedly be made. Alderman Theuring says that he intends to make it his business to see that this is done, and even Alderman Kuth, the chairman of the council committee on railroads, who is supposed to be very friendly to the Milwaukee Street Railway company, says that the company ought to pave between its tracks.

The new Clybourn street line of the Milwaukee Street Railway company has been opened. The line runs from the lake shore along Wisconsin street and Grand avenue to Sixth street, thence to Clybourn street and thence to the city limits at Thirty-fifth street. Between Twenty-first and Twenty-fifth streets the company had to fill a ravine some 100 feet wide at the top and 30 feet wide at the bottom. Next spring the new line will be extended to the Soldiers Home, a distance of about a mile, the line running down the Menomonee valley directly west for half a mile, thence running three blocks south, crossing the tracks of the St. Paul railroad company and the river by means of a high viaduct to be erected this winter, and thence running directly into the Soldiers' Home grounds. The line will be of great benefit to the people working at the West Milwaukee shops and will also afford easy access to Calvary cemetery.

The Common Council has awarded to the Johnson Electric Service company the contract to furnish an electric clock for the new city bell tower and the price is $1,900.

The survey for the La Crosse and Merrillan electric line has been completed and further developments are awaited with interest. A considerable part of the right of way has been secured. The line is to pass the Black River Falls and the entire distance is 55 miles.

The Filer & Stowell company of this city is building one of the largest electric power house engines ever manufactured. It is to be used on the Chicago North Side Electric Railway system, owned by the Yerkes syndicate, and is to drive a directly connected Siemens & Halske generator. The flywheel of the engine will weigh 100,000 pounds. The engine will be of the cross-compound type, with cylinders 24 and 48 inches in diameter, 48 inch stroke. The crank shaft will be 24 inches in diameter and will be made of hollow fluid-compressed steel.

A few days ago Julius M. Jensen, a conductor on a Russell avenue street car, proved himself a hero. His car, through no fault of his own or of his motorman, crashed into a wagon in which there was a woman who was driving and whose horse had become uneasy and had backed in front of the car. The woman was thrown out backward and she fell within two or three feet of the front of the car and almost under the wheels. Jensen, however, had stepped upon the footboard, and when the car struck he jumped forward and caught the woman. He is a small man, and the weight of the woman, who was large, threw him against the car, but he escaped death and saved the woman besides. Neither was badly hurt. A moment later the conductor was getting the names of the woman and two or three passengers for the purpose of showing that the accident occurred through no fault of his. He did not seem to think he had done anything out of the ordinary.

C.

## Northwestern Notations.

MINNEAPOLIS, September 28.—It is reported that a wealthy New York man has been found who is willing to brave Mr. Lowry's displeasure and antagonism and build the much longed-for street car line from St. Anthony Park to Minneapolis. The fight for a franchise will be a royal battle, for Mr. Lowry will hardly sit quietly by and see a competitor enter the field which is now his alone. He will be aided by the St. Paul council, which will have to grant the franchise to the newcomer, as St. Anthony Park is within the limits of St. Paul; hence the outlook for the proposed line is still far from rosy.

Thos. Wallace, Jr., wants $5,900 from the Carpenter Electric company in St. Paul, for merchandise delivered the defendant by the Ansonia Electric company of Chicago.

The village of Biwabik, Minn., recently appointed a committee to confer with the Biwabik Bessemer company to find out what that company would furnish the village with electric lights for. The committee reported that the company would furnish lights for $30 per month per light. As Virginia, Minn., secured lights for $12.50 per light per month the Biwabik people think the local company ought not to be charged more than that, and they are thinking of putting in a plant of their own.

The village of Sleepy Eye, Minn., has just bought two 35 light dynamos and a complete plant to replace the plant which was ruined by fire last May.

Worthington, Minn., is taking bids for an electric light plant.

La Porte City, Ia., has voted $25,000 bonds to put in an electric light and waterworks plant.

Margaret E. and Robert E. Bader have sued the Minneapolis Street Railway company for $10,000 and $5,313.60 damages respectively, from the result of a runaway caused by the horse becoming frightened by the sudden opening of the safety gates with which the company has equipped all its cars. It is claimed that the company violates the ordinance in occupying more of the street than the ordinance grants, and the plaintiffs also claim the gates to be a dangerous appliance.

The Western Electric company of Chicago secured the contarct to put in an electric light plant for Windom, Minn.

There is a prospect for trouble in Moorhead, Minn., when the local electric plant starts up. The Fargo Electric Light company, which has supplied light to consumers in

Moorhead, has notified them that when they cease to take light the company will remove all globes, fixtures, etc. Inasmuch as the company charges consumers for these, it is difficult to see where the claim comes in. One man was charged $4.50 each for two three light reflectors, and was charged for the time taken to put them up.

J. G. Stevens, who owns the Stevens Point, Wis., waterworks bonds, is negotiating to secure the Clark water power and consolidate the electric light system with the waterworks.

F. McCormack of Duluth has applied for an electric light franchise at Two Harbors, Minn.

A new electric light company has begun operations at McGregor, Ia.

C. W. McElyea secured a franchise to build a street railway from the business section to the Normal school in Cedar Falls, Ia., and will have it in operation by November 1st.

Electric lights will probably be put in at Winthrop, Minn., this fall.

M. E. Daneher will make an estimate of the cost of an electric light plant for Fergus Falls, Minn.

Electric lights and waterworks will probably be voted on soon at Le Sueur, Minn.

The Albert Lea Electric company of Albert Lea, Minn., secured the contract to furnish 26 arc lights at $7 per month per light for five years.

An electric light plant is being built at Hamburg, Iowa.

The City Council of Dubuque, Iowa, refused to grant an extension of 99 years on the franchise of the Dubuque Street Railway company, owing to the pressure of public opinion. The present charter runs for 20 years yet, so the matter is scarcely urgent.

Receiver E. E. Clark of the St. Cloud Street Railway company of St. Cloud, Minn., has filed his bond and will now make a demand for possession of the property. Those in possession claim it under sheriff's sale for personal property taxes and refuse to give it up.

The Consumers' Electric company has incorporated in Seattle, Wash., and will take all the business of the Third Street & Suburban company, except the street car property. This will remove an obstacle toward consolidating all street car lines in the city into one company.

There is considerable of a tangle at Bismarck, N. D., over a lighting contract. The council originally passed an ordinance granting Edmund A. Hughes a contract for electric lighting. The contract was not signed by Mayor Leslie, and at a subsequent meeting the council repealed the ordinance and expunged from the record that part relating to the franchise proceedings. Hughes then tried to secure a writ of mandamus to compel the mayor to sign the contract, but the judge refused to grant the order. New proceedings were immediately begun before the United States Court at Fargo, ordering the mayor to show cause on October 7th why Hughes should not have the contract. In the meantime poles had been distributed along the streets and arrangements made to string wires and have the plant in operation to furnish private customers with light by September 20th. The day following the distribution the council met in special session and passed a resolution ordering Hughes to remove the poles from the streets, forbidding the placing of the poles or stringing electric light wires, and ordering the chief of police to remove the poles in case Hughes did not do so within 24 hours.

The Electric Light company of Grand Rapids, Minn., will soon build another building and add new boilers.

The Western Union Telegraph company is rebuilding its line between St. Cloud, Minn., and Minneapolis.

The American Signal & Power company of Minneapolis has been incorporated with $100,000 capital stock to manufacture electrical appliances and special patents which it controls.

The People's Power company of Moline, Ill., will build a new power house and put in 10 new water wheels. This company furnishes all the arc lights in Moline, Rock Island and part of Davenport.

The Davenport & Rock Island Street Railway company will soon be reorganized.

The Minneapolis Street Railway company is testing fenders on some of its cars. They consist of an iron frame with a network of rope inside, and project from the front platform. They hang about six inches above the track and look capable of giving a basis for a damage suit against the company should one have the misfortune to get under them instead of on top.

Electric light bonds for $70,000 were voted at Escanaba, Mich.

The Crookston Water Works, Power & Light company of Crookston, Minn., is changing from the Thomson-Houston to the Edison system. New machinery will be added.

Bonds were voted at Windom, Minn., for electric lights and water works recently, but injunction proceedings were begun which prevented work. The injunction has been turned down in the courts now, and that enterprising village will secure its light.

St. Paul has contracted with the Gas Light company to change the gas lights in the business part of the city and place 2,000 candle power electric lights instead.

Conkey Bros. of Preston, Minn., contemplate using their water power for electric light purposes. There is also considerable sentiment in favor of putting in a municipal plant, and it is probable that between the two Preston will have light soon.

Dr. A. J. Stowe, W. Wadlow and C. F. Jackson were granted a 30-year electric light franchise at Rush City, Minn.

Westminster Presbyterian church, Minneapolis, was burned recently, and in his report Fire Marshal C. O. Pierce attributed it to "a burn-out in the electric light transformer caused by lightning discharge, which threw the primary current on the secondary circuit. The primary current on secondary circuit jumped to the gas pipe of the center chandelier, thence through defective insulating joint to the ground, setting fire to liberated gas at joint." This report is understood to have been indorsed by City Electrician Pillsbury. Later, however, Mr. Pillsbury tested the transformer and it stood a test of 1,000 volts, and he declares it was impossible for the fire to have caught from electric wires.

Manager Gill of the Montevideo Roller Mill of Montevideo, Minn., offers to put in electric power and furnish the city with electric lights.

The troubles of J. K. Tillotson of the Central Wisconsin Inter-urban Electric company at Oshkosh, Wis., do not seem to be over. The Paul Perrinzo, Jr., Cedar Tie & Lumber company of Marinette has sued Tillotson and the company, garnisheeing the Commercial Bank, city treasurer and others and attaching the track laid and the franchise from the city to recover a claim of $1,613 alleged to be due for ties. Tillotson's friends claim it is persecution.

There is considerable sentiment at Mason City, Iowa, in favor of the city owning the electric light plant.

A heavy hailstorm at Eau Claire, Wis., damaged the street railway company's power house over $800, breaking every glass in the skylights. Of course the hailstones were big as hen's eggs.

Ironton, a suburb of Duluth, is after street car service, and the Duluth council is considering a resolution looking toward ordering the street railway company to furnish it.

The city of Escanaba, Mich., has purchased the local electric light plant for $70,000.

Citizens of Howard Lake, Minn., are in favor of voting on electric light bonds.

The McGregor Electric Light & Power company has been incorporated at McGregor, Ia., with $10,000 capital stock.

The Minneapolis city council has given the electric companies another extension of 30 days to get the wires underground, making in all six years of extension since the ordinance was first passed.

An electric line is proposed between Tipton and Wilton, Ia.

There is considerable sentiment in Radcliffe, Ia., for electric lights.

The capacity of the electric light plant at Marquette, Mich., is to be tripled by building a new dam and putting in additional water wheels at a cost of $10,000.

The cost of electric lights at Rhinelander, Wis., is considered too high by several of the business houses there, who have ordered out the lights and returned to kerosene lamps.

J. C. Seelye of Brainerd, Minn., has a scheme to build a single rail electric line across Crane Lake portage, near the Rainy Lake gold fields, of about 27 miles in length. He thinks it could be built for $50,000, and there would be money in it, owing to the great travel to the gold fields.

W. D. Craig, G. W. Motley and N. Blian will generate electricity at Franklin, S. D., using power from an artesian well.

About $500 damage was done the electric light station at Aberdeen, S. D., by fire.

It is understood that contracts for constructing the La Crosse, Black River Falls and Neillsville electric line will be let about October 1st.

City Electrician Goldschmidt of Davenport, Ia., is pushing a new ordinance which provides for official inspection of electric wiring, something which has long been needed there.

M.

## PERSONAL.

Herbert A. Wagner, of the Wagner Electric Manufacturing company and J. H. Rhotehamel, president of the Columbia Incandescent Lamp company, St. Louis, were in Chicago this week.

George D. Rosenthal, St. Louis agent of the General Electric company, made a flying trip to Chicago on Wednesday of last week. Mr. Rosenthal only gave his friends a glimpse of himself, as he returned Wednesday evening to St. Louis. He reports business prospects for his territory as excellent.

R. Leo Van der Naillen has been obliged to resign his position as the western manager of the Boudreaux Dynamo Brush company and return to California, owing to the poor health of his wife. All who had occasion to meet him during his stay in Chicago will certainly regret his departure.

## ELECTRIC RAILWAYS.

C. E. Loss has secured the franchise for an electric road in Waukegan, Ill. He has given a $5,000 bond to have a line running south from the business center to the Washburn & Moen works by January 1st. Five years is allowed in which to build lines running north and west. The downtown track will be put in at once, along with the brick paving.

Allen J. Beaumont, special master in chancery named by Judge Hallett of the United States Circuit Court in the decree of foreclosure in the suit of the State Trust company against the Pueblo, Col., City Railway company and the International Trust company, sold the real and personal property of the Pueblo City Railway company at auction recently. The only bid made was $400,000, and it was sold for that amount. A new company has been formed to run the line, and it at once took charge.

The Richmond, Ind., street railway plant, which has been in the hands of a receiver for the past eight months, was sold on September 14th by the sheriff of Wayne county. The line was bonded by J. C. Shaffer, its former owner, for $200,000, and these bonds were held by S. A. Fordyce, B. F. Hobart and Colonel Kerens, all capitalists of St. Louis, and by the Union Trust company of St. Louis. There was an indebtedness on the line of nearly $150,000. In the Wayne Circuit Court Judge John D. Miller of Greensburg decided that the claim of the bondholders was the prior one. Mr. Fordyce, on behalf of the bondholders, made the highest bid, $50,000. It is expected that the bondholders will sell their purchase within a short period for not less than $125,000.

## TRADE NEWS.

The Electric Appliance company of Chicago, as general western agent for the Grutting electric heating appliances, is offering something very fine in the line of an electric soldering iron and an electric curling iron heater. The company has some interesting circulars on these goods, going considerably into detail, which it will be glad to furnish on application.

Central station managers and construction companies will be interested in the claims made by the Frick company of Waynesboro, Penn., for the automatic steam engines which it is turning out. The company has some excellent types of directly connected equipments, described in the catalogue just issued. The pamphlet is worthy of a place in every central station in the country.

The Bradford Belting company's first catalogue will be issued about November 1st. The following are the company's specialties: Crefeld rubber wire, "Bradford" incandescent lamps, Waterhouse arc lamps, Perkins switches, sockets and cutouts, E., E. & S. specialties, Peerless compound, "Monarch" tape, splicing compound, Edison cutouts and fuse plugs. The company's Chicago office is at 236 Randolph street.

The Central Electric company, Chicago, has just completed arrangements with the Changeable Electric Headlight company of Syracuse to act as general western sales agent for what is claimed to be the "best and simplest electric headlight in the world." The company is putting up a fine display board in its salesroom, exhibiting type C material and Billings & Spencer products. Callers will be invited to examine and benefit by this exhibit.

Owing to the increased demand for P. & B. products abroad, it has become necessary for the Standard Paint company to establish headquarters in England, and for that purpose President Shainwald sailed from New York on the "St. Louis" on Wednesday, September 25th. Mr. Shainwald contemplates spending two or three months abroad and he expects to establish agencies for the sale of P. & B. products in all the principal foreign cities.

The C. E. Woods company, Monadnock building, Chicago, is preparing to extend its business in New York and Chicago, and eventually establish a branch at Tokio, Japan. This company has a trained force of consulting and supervising engineers, and is prepared to design dynamo electric machinery and heavy equipments of all kinds. New applications of electricity are exploited, developed and applied. This feature of the company's business has proved very satisfactory to both the company and its clients.

In the latest pamphlet issued by the Manhattan Electrical Supply company of New York, the following announcement is made: "We will pay $100 cash for the privilege of defending a suit brought by the Bell Telephone company on the Berliner patent against dealers or users of our telephones; the action to be brought in any state in the Union. The above amount will be promptly paid to the first person furnishing us evidence of the commencement of such action, with authority for us to handle the defense of the same." The catalogue describes many specialties of this company.

The Joseph Dixon Crucible company of Jersey City, N. J., has taken the trouble to get the views of practical men upon its products. While some railroads have used Dixon's graphite for many years and many master mechanics and engineers are fully aware of its economy and usefulness, the company has not until quite lately attempted to bring it more fully before railroad officials and engineers. Lately it has been sending samples to engineers, and the letters and extracts printed in pamphlet form show how useful even the small samples have proven, and the evident economy and the saving of oil and dollars if Dixon's graphite should be generally adopted by railroad companies.

The Lombard Water-wheel Governor company, 61 Hampshire street, Boston, is receiving some very flattering

testimonials from users of its governors. A large paper company which has been employing the governor for five months states that it gives perfect regulation. The Montague Street Railway company of Greenfield, Mass., has a governor in its power house at Millers Falls which it says takes care of the two wheels to perfection. Another concern after testing the governor thoroughly writes that it has given excellent satisfaction, not permitting the wheel to vary over 2 or 3 per cent., and that it is the only apparatus that will govern a wheel under different variations of flume. With such a perfect governor in the market the use of water power for generating electric power should be largely increased, and in such places as have suffered from want of regulation an easy remedy is offered.

The American Steel Casting company, Thurlow, Pa., is authority for the statement that castings for electrical purposes are a distinct and special production and should receive the most careful attention, with the view of attaining the best results in an electrical point of view. The electric curves showing the magnetic saturation of metal in this company's products, it is said, is equal to that obtainable from Swede iron. Gears, motor and generator frames, pole pieces, oil cups and caps, etc., are produced promptly on receipt of requisite pattern. The company is making blank gears in large numbers, and believes that it is supplying nine-tenths of the blank steel gears used in the street-car motors in this country. These gears are required to be entirely free from honeycomb. The machinist may discover, on finishing a blank gear, after nearly completing the same, a small defect coming on the exposed part of the tooth, that will cause the rejection of the casting.

## BUSINESS.

The Boudreaux Dynamo Brush company reports a steady increase of business all over the country. The Robinson Engineering company of Baltimore has secured the sole agency for Maryland, Virginia and the District of Columbia.

S. S. Creider of Sterling, Ill., reports several fine contracts for the Whiteside Harrison Telephone company, of which he is president. The company is having the usual amount of trouble on account of the Bell company's opposition, but it is making progress rapidly and steadily, and hopes to secure a complete victory.

The report of the test on Packard lamps made by Prof. Benj. F. Thomas, of the Ohio State University, in the station of the Columbus Edison Electric Light company, June, 1895, which was published in this journal at the time, has been printed in pamphlet by the company, and lamp users will find the data very interesting and instructive.

In the last issue of the WESTERN ELECTRICIAN an item was published to the effect the Pumpelly-Sorley Storage Battery company of Chicago had "closed the following contracts during the last week: 240 200 ampere hour cells to the St. Joseph & Benton Harbor Electric Railway Light and Power company of St. Joseph, Mich., to be used as an auxiliary in conjunction with the railway plant, this being the first installation of storage batteries for electric railway purpose in the United States." This last statement should be corrected in justice to the Electric Storage Battery company of Philadelphia, for this last named company has had for some time what is claimed to be a very succesful storage battery plant for railway purpose at Merrill, Wis. The Electric Storage Battery company has recently established an extensive office in Chicago, 309 Dearborn street, under the management of C. W. Woodard. Mr. Woodard very naturaly desires that his company's excellent work at Merrill, Wis., should not be overlooked. It may be said incidentally that Mr. Woodard has already done extensive work for his company in the West since coming into Chicago a stranger this fall. He has taken hold of the business with an energy and determination that undoubtedly will bring to his company good returns in the shape of increase of its already growing business. He has up to this time made some extensive sales and has almost in his grasp several handsome contracts.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued September 24, 1895.*

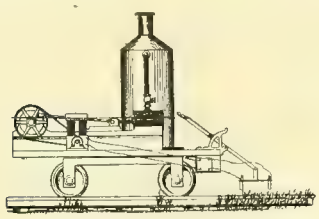
546,666. Means for Varying Light for Incandescent Electric Lamps. Charles A. Hussey, New York, N. Y. Application filed September 29, 1893.

A socket for incandescent lamps is provided with a key for cutting into circuit a greater or less number of resistance coils to vary the intensity of the light

546,674. Electric Time Switch. James F. McLaughlin, Philadelphia, Pa. Application filed April 11, 1893.

A rotary switch controls the circuit, while a spring motor rotates the switch, and a lock controls the operation of the switch motor. a time piece controls a setting mechanism, whereby the time-piece operates to release the switch motor at predetermined times.

546,682. Apparatus for Exterminating Vegetation. Albert Scheible, Chicago, Ill. Application filed January 22, 1895.



NO. 546,682.

A pair of electrodes are carried upon the vehicle, one connected with each side of a source of electricity. The electrodes are moved over the vegetation to be exterminated in contact with the foliage, and the current passes from one electrode to the plants, and through the stalks and roots thereof to the moist earth in contact with the roots, thence to the roots and through the stalks and foliage of the plants, which are in contact with the second electrode. The passage of the current through the roots of the plants is thus insured.

546,689. Electric Arc Lamp. Conrad Weber, Friedrich Goellner and Albert Schweitzer, Allegheny, Pa. Application filed November 19, 1894.

The curved carbons are mounted upon pivoted carriers connected with the solenoid of the feeding magnet through a toggle joint.

546,691. Continuous Current Rectilinear Motor. Clinton E. Woods, Chicago, Ill. Application filed April 6, 1895.

The motor is to be used for propelling vehicles, and comprises a number of coils mounted upon a core and connected end to end, the coils being connected with the segments of a commutator, upon which rest brushes connected with the source of current supply. A shifting magnetic field is produced in the core which reacts upon stationary poles along the line of travel to propel the vehicle.

546,700. Means for Analytically Recording Gait of Horses. Thomas J. Kean, Philadelphia, Pa. Application filed December 5, 1894.

A receiving surface is advanced at a rate corresponding to the speed of the horse, and electrically controlled means record the speed upon the recording surface.

546,724. Electric System. Merle J. Wightman, Johnstown, Pa. Application filed April 3, 1895.

A dynamo electric machine is provided with a single armature and a plurality of fields, the fields being independently connected with the source of current; a connection extends from the source of current to the portion of armature controlled by one field, while another connection extends from the portion of the armature controlled by another field to a working circuit

546,725. Self-acting Commutator for Telephones. Salomon Berditschewsky dit Apostoloff and Moise Freudenberg, Paris, France. Application filed March 27, 1895.

Switching apparatus is provided whereby the subscribers may connect themselves at will with a subscriber with whom it is desired to converse.

546,731. Telephone System. William W. Dean, St. Louis, Mo. Application filed May 18, 1895.

A local circuit is provided at each sub-station, comprising two branches, one containing the microphone and the other the primary of the induction coil. The circuit is supplied with current from a battery at the central station, which is switched into circuit when connection is made with the line.

546,739. Method of Making Porous Plates or Electrodes. John Johnson and James H. Robertson, Brooklyn, N. Y. Application filed April 2, 1895.

The method consists in making a mechanical mixture of molten metallic lead and granulated pumice stone, and then subjecting the mixture to an electric current

546,756. Production of Displaced Phases and Rotary Fields. Charles S. Bradley, Avon, N. Y. Application filed December 24, 1894.

The apparatus comprises a coil influenced by the line current, and a coil whose current phases are a resultant of two branch currents passing through a condenser and inductance respectively.

546,799. Electric Light Display System. Jonathan E. Woodbridge, Duluth, Minn. Application filed July 8, 1895.

An electro-magnetic switch is provided in connection with each of a number of lamps for closing the circuit through the lamps, while a hand-switch is provided for opening the circuit through all of the lamps.

546,802. Screening Electrical or Other Instruments and Apparatus. William E. Ayrton and Thomas Mather, London, Eng. Application filed July 3, 1893.

The device is designed to screen electric instruments from disturbances caused by electric forces, and consists of a transparent cover and a transparent electrically conducting screen of adhesive material covered by a protective coating.

546,806. Frequency Changer. Ernst J. Berg, Schenectady, N. Y. Application filed June 21, 1895.

An induction motor has its inducing member supplied with current from a generator of high frequency, while drills or other apparatus requiring currents of low frequency are connected with the induced member of the induction motor, a generator being operated by the induction motor supplied by an exciter, which also sends current through the continuous current coils upon the drill.

546,820. Electric Switch. George E. Linton, Worcester, Mass. Application filed January 4, 1895.

The construction is such that the contact pieces are clamped into close engagement with the switch-knife to lessen the resistance through the switch.

546,821. Electric Switch. George E. Linton, Worcester, Mass. Application filed January 4, 1895.

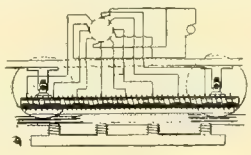
An improved spring construction is provided for moving the switch blades quickly out of engagement with the contact pieces.

546,826. Electric Arc Lamp. Rupert Schefbauer, Paterson, N. J. Application filed November 16, 1894.

The carbons are carried upon swinging arms provided with segmental racks engaging pinions upon a shaft, adapted to be rotated by the regulating mechanism.

546,827. Electric Arc Lamp. Rupert Schefbauer, Paterson, N. J. Application filed March 5, 1895.

The lamp is intended for use with alternating currents, and the invention consists in means for preventing the vibration of the core of the magnet from similarly vibrating the carbons.



NO. 546,691.

546,828. Electric Arc Lamp. Rupert Schefbauer, Paterson, N. J. Application filed March 5, 1895.

A number of switches are provided, one for turning off the current from a lamp without disturbing other lamps on the circuit, and one that closes the circuit automatically when the carbons are burned out, and brings into the main line a resistance equal to the resistance of the arc.

546,834. Electro-magnet for Pipe Organs. Edwin S. Votey, Detroit, Mich. Application filed January 21, 1895.

A wind box is provided, within which is situated a pneumatic, an electro-magnet being provided with a base forming an interior chamber communicating with the pneumatic and with an exhaust passage. An electrically controlled valve in the chamber of the base controls the circuit through electrical conductors controlling the operation of the electro-magnet.

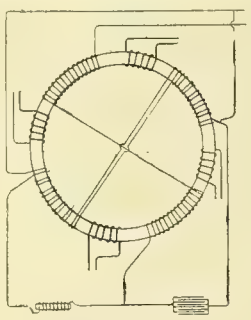
546,837. Insulating Support for Electric Wires. Joseph N. Bulkley, Ridgway, Pa. Application filed March 4, 1895.

A headed bolt and nut is employed, with wedging tubular sections diagonal from end to end, and adapted to fit over the bolts, and to be arranged to overlap each other in wedging relation to each other.

546,874. Electrical Indicating System for Annunciators. Walter F. Banks, Milford, Conn. Application filed October 2, 1893.

The system is adapted to indicate at the office the service required at any room in the hotel, and a return signal to the room when the call is noted. The annunciator circuit is closed but an instant when a signal is sent, whereby waste of battery current is prevented.

546,892. Telegraphic Vibrator. Paul la Cour, Askovshus, Denmark. Application filed May 7, 1895.



NO. 546,756.

A separately mounted movable circuit controller rests normally in contact with the vibrator, and a catch is arranged to hold the circuit controller back from the vibrator after the controller has been actuated by the vibrator.

546,901. Attachment for Electric Generators. George W. Pickett, Denver, Colo. Application filed January 12, 1895.

A two-part commutator is provided on the dynamo, having separated ends, between which rests a bearing sleeve; an auxiliary commutator is provided, which is revoluble on one end of the main commutator.

546,904. Combined District Telegraph and Telephone System. Edgar E. Salisbury and Albert E. Dean, Tacoma, Wash. Application filed August 21, 1894.

A telephone supporting lever winds the actuating spring of the call-box by the weight of the telephone when hung thereon, but is capable of being lifted by the spring when the lever is released by the removal of the telephone.

546,917. Electric Meter. Jules A. Déjardin, Paris, France. Application filed April 20, 1895.

A coil is suspended from a pivoted balance wheel, and is adapted to be acted upon by a fixed coil. The supply current passes through the coils, and the force acting upon the suspended coil tilts the beam.

546,957. Fuse Connector. Alfred Gartner, Newark, N. J. Application filed July 25, 1895.

The terminal plate is provided with slots in its end to be engaged by the binding screws, a spring loop being centrally arranged and projecting perpendicularly from one side of the plate, while an extension projects from and laps under the plate.

546,965. Telephone. George A. Tower, Maurice Hunter and Joseph P. Eastwook, Richmond, Va. Application filed December 20, 1894.

The telephone comprises a carbon diaphragm, against the rear face of which rest a number of pivoted triangular blocks, the ends of which rest against the diaphragm, due to the weight of the carbons.

546,966. Electrical System of Motor Regulation. Merle J. Wightman, Johnstown, Pa. Application filed March 27, 1895.

A dynamo is employed, having a single armature, one portion of which is in shunt to the source of constant potential, and another portion of which is in shunt to the source of constant potential and in series with the working circuit.

564,972. Telephonic Attachment. Louis J. Gerson, Philadelphia, Pa. Application filed January 14, 1895.

A speaking tube is connected to the frame by means of a ball and socket joint, whereby the tube may be turned in any direction.

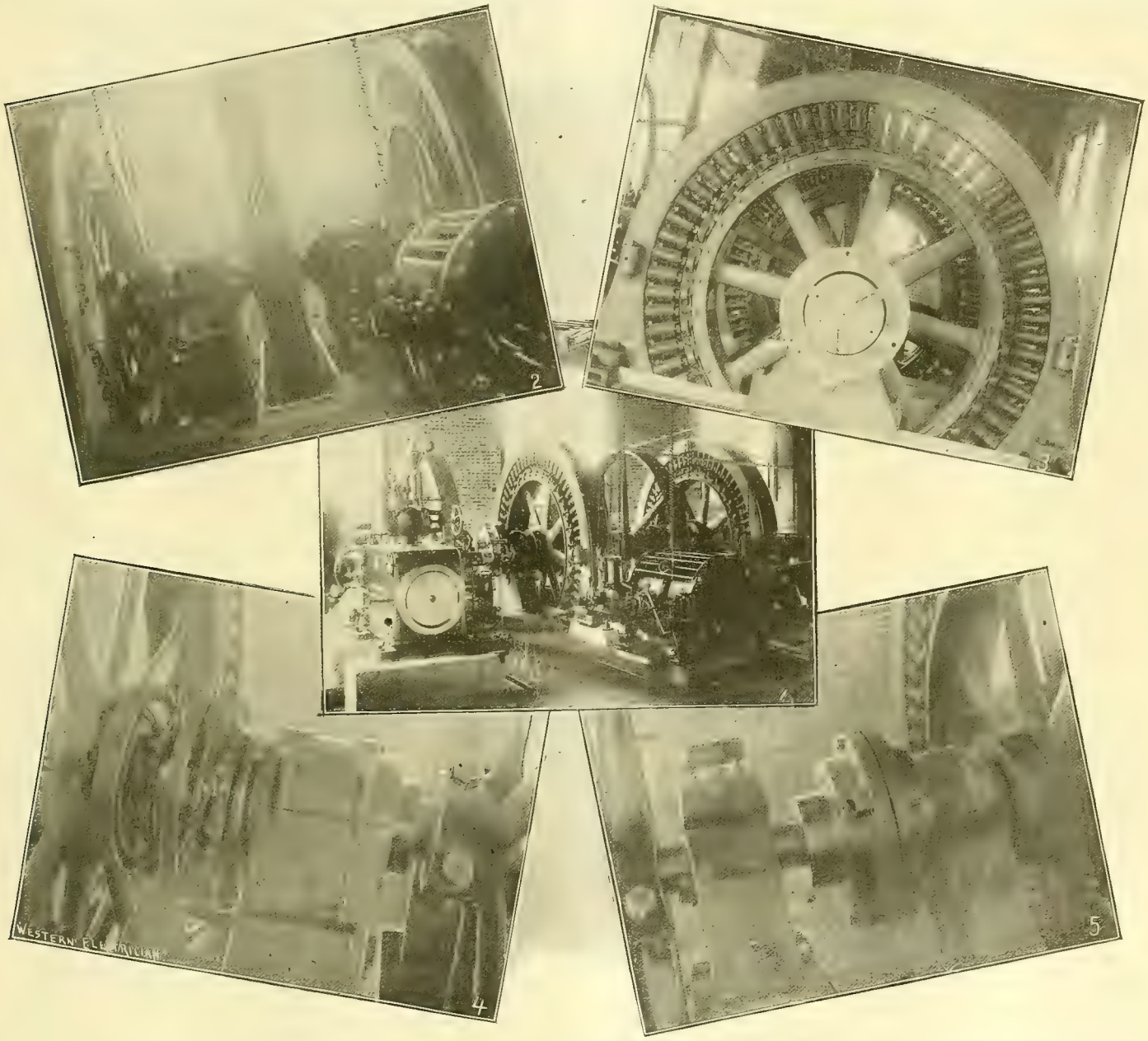
Western Electrician.

EVERY SATURDAY.

Vol. XVII. CHICAGO, OCTOBER 12, 1895. No. 15

## Arnold's Power Station System at Fort Dodge, Iowa.

More than a year ago, on May 19, 1894, a description of an electric power station system, designed by B. J. Arnold of Chicago, was presented in the WESTERN ELECTRICIAN. At that time it was only possible to describe the system in a general way, as a commercial plant built on the lines proposed had not then been put in actual operation, but Mr. Arnold's success in similar work gave assurance that the new system would be worthy the attention of engineers. In the previous article the system was described, and its application to various kinds and classes of electric power systems was explained. In the present article a commercial plant in operation, employing this system, built by the Nordberg Manufacturing company and installed under the direction of Mr. Arnold, will be described in detail. The equipment referred to is that of the Fort Dodge Light & Power company at Fort Dodge, Ia. This is the first system of the kind that has ever been installed, and it has consequently attracted much attention. Fig. 1 shows the general view of the power system as it now exists. It will be noticed that there are certain arc and incandescent dynamos shown in the cut, which ordinarily would not be in a station built in accordance with the plans of the designer, but they are necessary in this case, owing fact that the company building this station owned an old electric plant, and in order to utilize as much as possible o n d machinery an auxiliary shaft was installed in the plant from which the old dynamos shown in the cut are driven. Ordinarily a plant consisting of two dynamos and two engines installed under the Arnold system would look like the equipment shown in Fig. 6. Fig. 2 is a view looking directly between the large direct-coupled General Electric monocycle generators, showing the double bearings and the rope driving sheave which operates the auxiliary shaft. Fig. 3 shows the end view of one of the monocycle generators with the necessary connections for attaching a second engine when it becomes necessary to install it. Fig. 4 shows the detail of one of the commutators and one of the double bearings hereinafter described. Fig. 5 shows the connecting mechanism between the engine and the generator. Fig. 6 shows the plant as it would have been installed had it not been necessary to utilize the old machinery. Fig. 7 shows the method of connecting the generators to the engines by means of electric clutches. This method is to be used when it is necessary to start and stop either generator without stopping the other generator or the engine, and Fig. 8 is the plan view of the Fort Dodge station, showing the method of increasing the plant; the dotted lines showing the machinery to be inserted in the future, and also giving a sectional view of the mechanism. Referring now to the sectional view shown in Fig. 8 *C c* are hollow cast-iron quills or shafts mounted in bearings *P p* and carrying the armatures of generators Nos. 1 and respectively. *E* is a steel shaft carried in bearings *D d* and extending each way from these bearings to the engine shafts, *A a*, and carrying upon its end disks *F f* securely keyed to the ends of the shaft; the quills being carried in independent bearings do not touch the shaft *E*, but clear the shaft one-half inch all around. On the ends of the engine shafts securely keyed thereto, are disks *H h*, corresponding with the ends of the quills *C c* already described. These disks or couplings and the ends of the armature quills do not touch disks *F f*, but have a clearance of one-half inch in all directions, thus allowing shaft *E* with its disks *F f* to lie idle or passive in bearings *D d*, while the quills revolve around it. When operating under normal conditions engine No. 1 drives generator No. 1 directly coupled as follows: Three rectangular steel keys are




FIGS. 1 TO 5. ARNOLD'S POWER STATION SYSTEM AT FORT DODGE, IOWA.

inserted in slots *U* spaced 120 degrees apart and secured in place by suitable bolts, thus coupling disk *H* directly to quill *C* by means of these keys, but in no manner making connection with disk *F*. The external view of this coupling with its keys is shown in Fig. 5. It will now be seen that the engine will operate generator No. 1 and not revolve shaft *E*. In a like manner engine No. 2 can be directly coupled to generators No. 2 and No. 3, so that we will have one small direct coupled unit of one-third capacity of the plant and one large directly coupled unit of two-thirds the capacity of the plant always available without revolving any shafting or having any more wearing parts than an ordinary directly coupled plant. Now suppose it is desired to couple generator No. 2 to engine No. 1, owing to generator No. 1 becoming disabled or for other reasons. To accomplish this it is only necessary to remove the three steel keys *U* and insert them in slots *V* spaced 120 degrees apart, the keys being secured in place by suitable bolts. In this manner quill *C* is released from disk *H* and disk *H* and coupled to disk *F*, which will cause shaft *E* to revolve when engine No. 1 revolves. If now there is inserted three additional steel keys in slots *w*, the effect will be to couple disk *f* to quill *c*, thus rigidly connecting the armature of generator No. 1 to the shaft of engine No. 1. Now remove keys from slots *u*. By starting up engine No. 1 generator No. 2 is driven directly coupled from it through the quill of generator No. 1, which is now standing still. In case it is desired to also drive generator No. 1 at the same time, it is done by inserting the keys in slots *U*, thus driving both generators from engine No. 1, and by similar connections with engine No. 2 any one or all of the generators can be driven from engine No. 2. Thus either one or all of the generators are available from the large engine unit and two of them available from the small engine unit; thus making it possible for a direct coupled plant with but two engines and three generators to have the same flexibility as an ordinary directly coupled plant with three engines and three generators, and at the same time saving the difference in cost between three small engines in one case and two engines, one large one and one small one, the combined power of which is equivalent to the three small ones, in the other case. By this method a saving in cost of foundations, cost of engines and cost of labor, fuel and oil to operate the plant is effected. If engine No. 1 were a compound engine, as would ordinarily be installed, and made sufficiently strong to allow high pressure steam to be worked in the low pressure cylinder, the operators of the plant would be able to drive generators No. 1 and No. 2 direct from engine No. 1 up to their full capacity, in case engine No. 2 should be disabled from any cause.

The method described of connecting the machines is only applicable where sufficient time is allowed to permit stopping the machines for making the necessary connection, as in ordinary lighting plants which operate about 12 hours a day. In case the engines and generators are operated continuously an electro-magnetic clutch system has been designed which permits coupling the generators and engines when running at full speed.

Referring now to Fig. 7, shaft *E* carries on its ends disks *F f* similar to the one hereinbefore described. These disks carry wrought-iron rings or armatures *L l*, *G g*, which are secured to the disks by round gudgeons or studs. The circular rings are held against the disks by coil springs surrounding these gudgeons, so that when the rings are not attracted by the passage of current through the coils hereinafter described, they remain compressed against disks *F f* and do not touch disks *H J*, *h j*. Disks *H h*, which are secured to the engine shafts, carry also circular wrought-iron disks *I i*, which are attracted by coils *M m* when necessary, Coils *M m*, *O o*, *N n* are copper wire wound in recesses and as engine No. 1, shown by a suitable indicator, current is passed through coil *n*, thus attracting circular armature *g* and coupling disk *f* to disk *j*, or securely connecting shaft *E* to the armature of generator No. 2. Now generator No. 2 is being driven directly from engine No. 1, and the current is now cut off from coil *M*, thus disconnecting the armature of dynamo No. 1, allowing it to come to rest. In a similar manner dynamo No. 1 can be coupled to engine No. 2, or either generator or both generators can be coupled to either engine, thus making an absolutely flexible directly coupled plant, and by using compound engines so designed that steam can be worked in the low pressure cylinders, both generators can be driven to their maximum capacity from either engine and allow one engine to stand still for repairs. With this arrangement of engines and generators equal to one-half the maximum capacity of any plant and a storage battery auxiliary also equal to one-half the maximum capacity of the plant, it is claimed that any electric railway or power plant can be operated with two engines and two generators

suitably arranged by means of brushes *K k* and *Q q* whereby current can be passsed through them so as to attract the circular rings or armature mentioned when necessary for coupling up.

By means of the magnetic clutch, formed by passing current through coil *M*, thereby attracting disk *I* which positively connects disk *H* to disk *J*, dynamo No. 1 is driven from engine No. 1 without revolving shaft *E*, and in like manner engine No. 2 can be made to drive dynamo No. 2.

In case dynamo No. 1 becomes disabled and it becomes desirable to couple dynamo No. 2 to engine No. 1 and shut down dynamo No. 1, current is passed through coil *O*, which attracts armature *G*, thus coupling engine shaft *A* to shaft *E* through disk *F*. Current is now passed through the field and armature of dynamo No. 2 in such a manner as to make an electric motor of it, and when it reaches the same speed

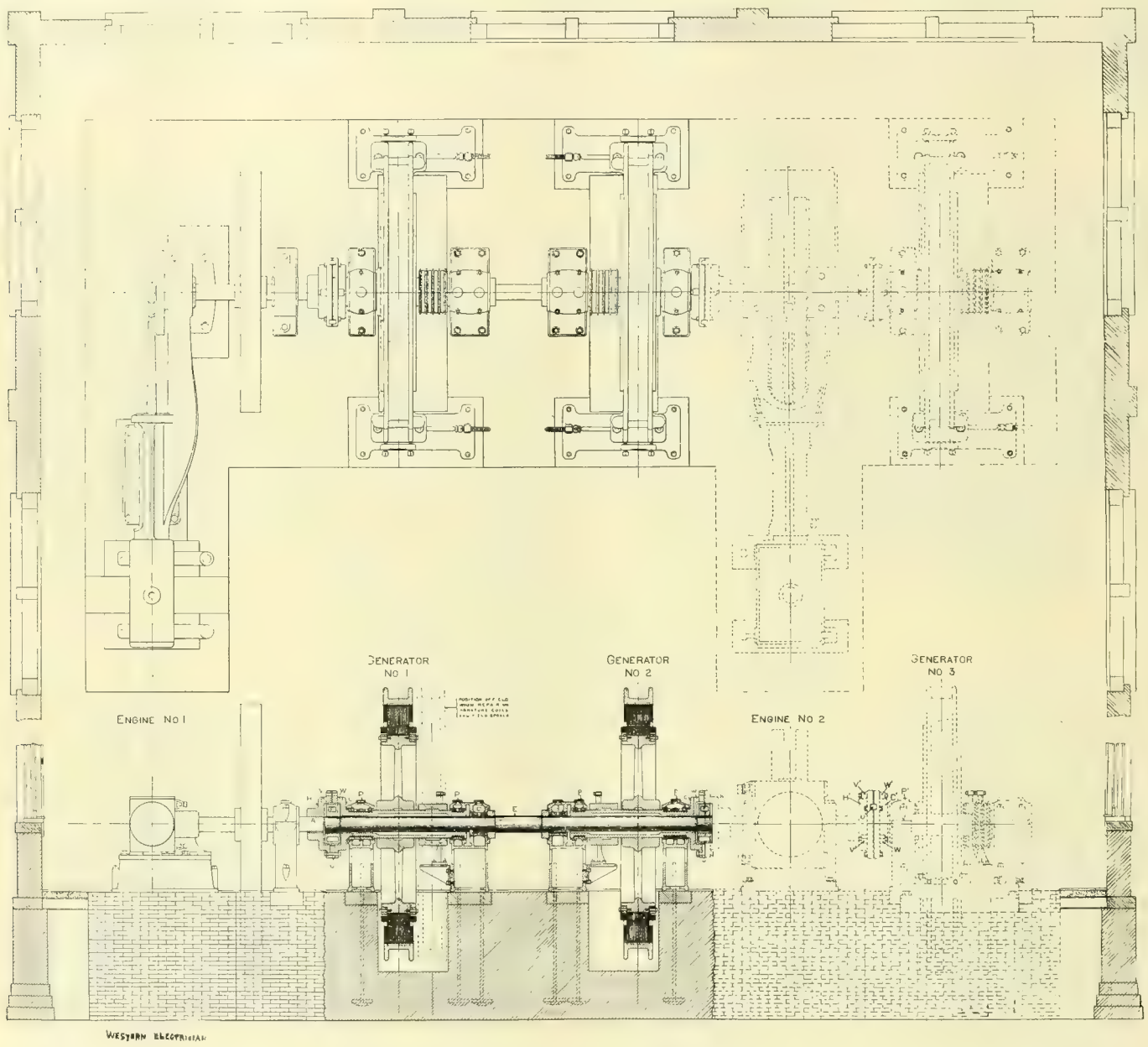



FIG. 8. ARNOLD'S POWER STATION SYSTEM AT FORT DODGE, IOWA.

with greater flexibility and for less money per kilowatt hour than by any system now built, and at the same time make the investment less than is usual under the present methods of construction.

The Fort Dodge plant started July 1st without a hitch in any respect and has been in successful operation ever since, to the entire satisfaction of its purchasers and the designer of the system. Owing to the great fly-wheel effect of the armature and engine fly-wheel under this arrangement 60 per cent. of the load of the plant can be thrown on or off without varying the voltage on the switchboard over 3/4

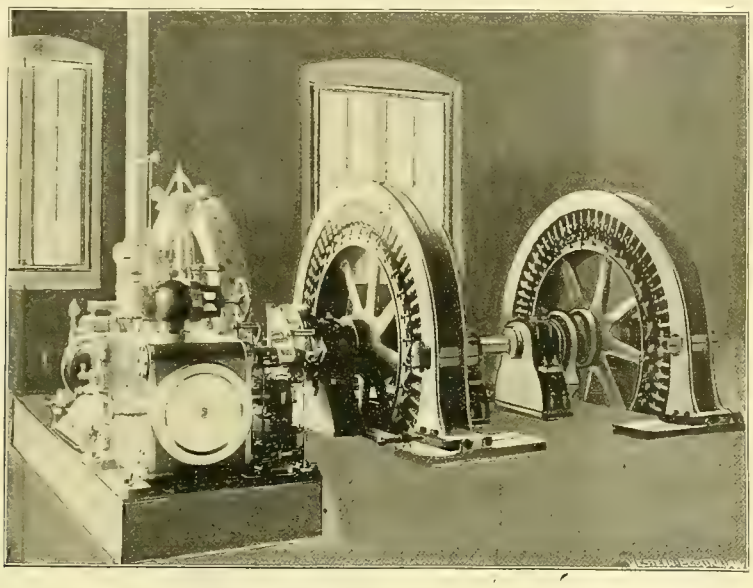


FIG. 6. ARNOLD'S POWER STATION SYSTEM AT FORT DODGE, IOWA.

volt. A company is now being formed to build central stations under these patents.

## An Electrical Solomon.

Why do the electrical people constantly aver that the general public is ignorant of the principles which govern electricity, when men of experience running through a period of 16 years, who have summered and wintered with the electric current, so to speak, are ready to yield up chunks of wisdom? Away over Sterling way, during the comfortless winter, when the cold weather caused the coal pile to shrivel, and the long evenings made it bad for the kerosene can and the frozen gas, the question of electricity came up and floated into the hands of an interviewer who sought an electrical solon and probed him. He—the solon—made an electrical expert of the interviewer, who gives the ignorant outer world some facts which, as Capt. Cuttle would say, "when found make a note on't." These are the words of the new fledged scientist, as he gave them recently in an Illinois daily paper:

A volt is the unit of electromotive force. An ohm is the unit of resistance; an ampere is the unit of current streng h. Twenty amperes constitute one horse power, and 1,000 amperes is called a killo-ampere; 746 watts constitute a horse power; 746,000 watts is called a killowatt; 32,000 pounds raised one foot in one minute represents one horse power in relation to steam engines, and four pounds of coal is used per horse power per hour.

One arc light is 2,000 candle power, and runs 50 volts on 4½ pounds of coal. Carbons cost $11.75 per 1,000; engineer or fireman 40 cents per hour. As applied to———— Falls 25 arc lights will illuminate the whole town, placing one in every other block. To do an equal amount of lighting by the incandescent system would require 80 lamps of 25 candle power, 50 volts, to equal one arc light in intensity.

Candle power is measured by the distance in feet of the reflected light of an ordinary sperm candle on a strip of black velvet. Manufacturers of incandescent machinery give nine 16 candle power lamps 50 volts to the horse power.

The first cost of an incandescent plant exceeds that of an arc plant by about $300. Figure up and say which is the cheaper sort of light for streets, and if any of the facts are erroneous tell us so.

Learned pundit, your "facts" are not "erroneous"—far from it. But, somehow, they bring to mind the little boy's conundrum: "Maw! Maw! How fast can a cow run up a alley a minute?" Flies do not rest on the Solomon's statements.

## Electric Car Held Up by Masked Men in a Chicago Suburb.

Four masked men boarded an electric car on the Chicago and North Shore Electric Suburban line at 8:25 o'clock last Monday night at the corner of Berwyn and Evanston avenues in Edgewater, a suburb of Chicago, and compelled the passengers to give up their valuables, not, however, until after a fierce struggle. Besides the motorman and conductor there were five men and two women on the car. Several were injured in the struggle, and all were thoroughly frightened. The car had been stopped on a lonely part of the road and the thieves got away with their booty unmolested.

## British Association Meetings.

Writing of the meeting of the British association an English correspondent of the *New York Tribune* presents a very attractive picture of the gathering. Instead of going to the larger towns, as an American society would, this writer intimates that the members are partial toward the smaller communities where they are made much more of than they would be in the busier commercial centers. A meeting of the association in a quaint, delightful town like Ipswich is a local event of overshadowing significance. The town hall is surrendered for a week to the men of science as their headquarters, reception-room, postoffice and printing bureau. All the best assembly-rooms are reserved for the work of the sections. Excursions are planned to every church, ruin and private park in the county; and the largest country houses are opened for the reception of visitors, lawn parties and

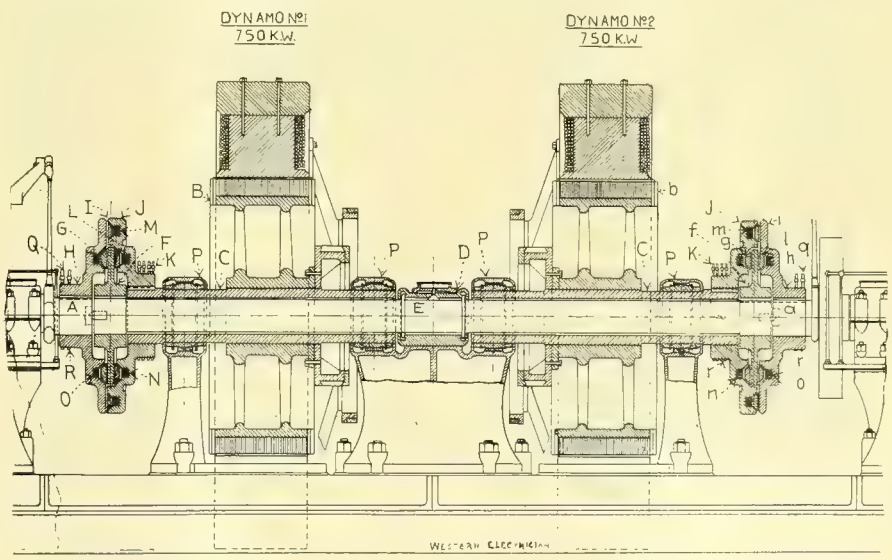



FIG. 7. ARNOLD'S POWER STATION SYSTEM AT FORT DODGE, IOWA.

afternoon teas. The section signs are painted in large letters in the main streets, so that no near-sighted or absent-minded stranger will be in danger of losing his way, and the local press makes elaborate preparations for printing daily supplements containing detailed accounts of the proceedings of the association. For a week the association is in complete possession of the town. Everything is done for the comfort of the members, and nothing else is talked about; and the conditions of environment minister to the self-esteem and enlightened self-respect of the wise men, their learned wives and their accomplished daughters.

Of the meetings of the several sections this writer says that exits and entrances are constantly made, and few callers stay for the close of a paper or of a discussion. Everyone is licensed to come and go as he pleases. Nobody is compelled by good manners to take more than a little of any science, nor to like that little long. The tall, handsome English girls hover for awhile about the dry stalks in front and try to get a few drops of the honey of wisdom out of them; and then they wing their way out, with a buzz of whispered conversation as they go.

It seems though that women play an important part in these meetings. They write papers on the most abstruse subjects, and read them with an authoritative air. Miss Dorothy Marshall has discoursed fluently on a method of comparing the heats of evaporation of different liquids at their boiling points. Miss Nina Layard has held forth on the subject of ultimate vital units. Mrs. Ayrton, with a yellow feather waving in her hat, and with a rich, perfectly modulated voice rising and falling melodiously, spoke with sweet reasonableness of the "Equation Connecting the Difference of Potential Current and the Length of the Electric Arc." She not only discussed this intricate mathematical puzzle, but she also covered the blackboard with a maze of figures and formulas and worked her way out of them calm and triumphant, while Lord Kelvin, Lord Rayleigh, Professor Hicks, Professor Rücker and all the other great men looked on and wondered. With as little apparent effort as would have been required for promoting the exchange of gossip at an afternoon tea, she explained her experiments with solid carbons, and Professor S. P. Thompson congratulated her upon producing the most accurate formulas which had yet been worked out

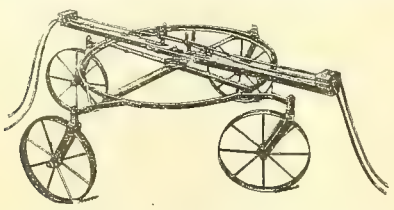
Of Lords Kelvin and Rayleigh there is much interesting personal gossip. The foremost man of British science is the position ascribed to Lord Kelvin, and he is pronounced the real leader of the association. He never misses a meeting of the mathematical and physical section, and he takes an active part in the discussions. He was at his best in giving an account of experiments conducted by himself and two associates in the electrification of gases. He has a strongly marked, benignant Scotch face, with gray beard and hair and a high forehead. While not a smooth and fluent speaker, since he has contracted the English habit of hesitation and reworking of sentences midway, he has an animated style, makes many expressive gestures and is most gracious and cordial in his manner. The lucidity of his mind is revealed when he is suddenly exposed to suggestions and criticisms, as he was this morning from Professor Lodge and others; and his kindness of heart inspires appreciative and magnanimous comments upon every paper that is read before the section. Lord Kelvin, great man of science as he is, has the simplicity of a child in his social relations and manner of life. He is an optimist who believes that the world is on the verge of scientific discoveries more remarkable than any which have ever been made.

The same writer is authority for the statement that after Lord Kelvin the second place of honor in the association belongs to Lord Rayleigh. He, too, is a frequent speaker in the discussions of the chemistry and mathematical and physical sections, and a very direct, logical and forcible debater he is. The account which he gave of his own investigations of his new element, argon, in connection with Professor Ramsay's experiments with helium was only intelligible to experts; but even if the audience could not follow the details, it was impressed with the intellectual struggle which had been in progress in the scientific laboratories and with the conquest of mind over matter which had been accomplished.

The trolley party fad has struck Des Moines, Iowa.

## Electric Plow in Germany.

Several applications of electricity to farm work have been suggested and some attention has been devoted to the development of these ideas, mostly, however, upon experimental farms. In this country farmers are loth to conduct experiments at their own expense and for this reason very little practical work has been done. But this hesitation about spending their own money and giving their own time to these projects does not necessarily imply a lack of interest in such matters. On the contrary the thrifty agriculturist is ever on the lookout for labor-saving devices, and the announcement made some time ago in the WESTERN ELECTRICIAN that a complete electrical equipment had been in-



ELECTRIC PLOW IN GERMANY.—CABLE CAE.

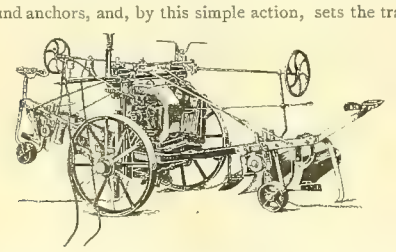
stalled upon a farm in Germany attracted considerable attention. Later advices concerning the progress of the experimental work were presented in this journal on May 18th and now an official report is at hand giving further particulars of this interesting work. The United States consul at Leipsic, Otto Doederlein, has made an elaborate report to the state department upon this subject and has furnished drawings illustrating the equipment, from which the accompanying cuts are made. Consul Doederlein says that although steam plows, in conjunction with locomobiles, have in the last 30 years shown great advantages over manual and animal labor, several objections thereto are irremediable, notably (1) their cost, (2) the expense of fuel and attendance, (3) the necessary water supply, (4) their size and weight, and (5) their inapplicability to small farms for the first four reasons, and small farms form an important part in this question of national economy. Size and weight are serious elements, in view of the looseness of the soil under treatment.

Locomobiles, owing to their long periods of inaction during the year, waste an immense amount of motive power. Moreover, the rate of payment is, for such reason, very high.

Electric motors, on the other hand, are (1) far less expensive to make; (2) far lighter in their construction, and, consequently, more portable; (3) they can be used at a far greater distance from the actual source of power, thus saving much haulage.

A stationary engine or locomobile for farming on a large scale transfers its elementary power through an electric motor to the seesaw, tilting, or balance plow, the motor being mounted on the plow itself, thus avoiding wire-rope traction. The anchor shaft of the motor sets in motion a double spur wheel, which, in turn, drives a pinioned shaft.

A chain extended over the field and held taut at both ends by triple ground anchors is worked by this pinioned shaft, which draws the plow along the chain across the field. On reaching the end of the chain, the plow is tilted to the other side and the simple reversal of the current sets the plow in motion in the opposite direction. In returning, it deposits the chain sideways ready for the next row of furrows. A laborer, by turning a lever, draws up the three ground anchors, and, by this simple action, sets the travel-



ELECTRIC PLOW IN GERMANY.—TWO-SHARE PLOW.

ing wheels affixed to the anchor axles in motion, so that the anchors are easily moved to the next furrow. The motor tightens the chain before starting; the slack length of chain thus deposited behind the plow allows for any inequalities of length resulting from the shifting of the anchors, which are also provided with a spare length of loose chains for use in case of need.

THE ELECTRIC PLOW IN SMALL HUSBANDRY.

There are three factors to be considered, viz. (1) the source of power, or primary station; (2) the transmission of such power; (3) the tilting plow, with its electric motor.

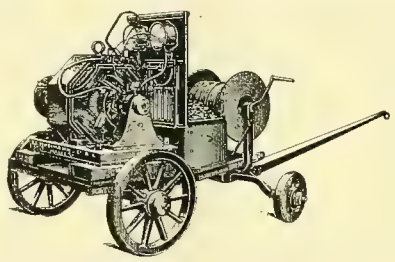
(1) *The Source of Power.*—This may be any ordinary agricultural locomobile of from eight to 12 horse power, but special care must be taken to furnish it with as sensitive a regulator as possible, in order to be able to surmount the irregularities liable to occur in switching the electric motor on and off, and also to prevent the occurrence of too great fluctuations in the number of revolutions. The locomobile may stand on any solid ground at the edge of the field to be plowed. It drives the dynamo, which is placed on a car.

This car also serves to transport the gauging apparatus for measuring the strength of current and tension, a reel or windle for the cable, as well as for bringing the plow to the field. One end of the tipping plow is fastened behind this primary station car by means of a cramp iron, while the guiding roller in the rear is placed so far downward as to rest on the ground and thus guide the plow. Locomobile and primary station together are thus brought to the desired spot with one team. As soon as the locomobile is set up accurately by means of brake blocks, the dynamo car is placed straight before it, fastened into the ground by means of an anchor placed opposite to the belt tension; the driving belt is placed over the driving wheel of the locomobile and the disk of the pulley of the dynamo machine, and the primary station is then in working order. The dynamo machine and gauging apparatus are protected against the weather by means of a cover. As the primary station is overlooked by the fireman of the locomobile, the dynamo machine does not require a special attendant.

(2) *The Transmission of Power.*—Two cables, corresponding with the two poles, serve to transfer the electric power from the dynamo machine to the electric motor. One end of this pair of cables is affixed to a projecting bar of the plow and moves backward and forward with it, like a pendulum, while the other pair of ends is secured to the dynamo machine.

The friction of the cable on the ground is avoided by means of light cable carriages fitted with insulating nippers. These carriages follow each motion of the plow automatically, as the wheels are fitted into forks, which, pivoting in every direction, answer to all the movementsof the plow.

Five or six such cable carriages, according to the length of the area to be plowed, are easily watched by a boy, who



ELECTRIC PLOW IN GERMANY.—PORTABLE DYNAMO.

has to take care that, in reversing the motion of the plow, they follow such motion.

(3) *The Tilting Plow, with Electric Moter.*—A tilting plow for small husbandry is fitted with two shares on each side. In front of each of these is a forecutter to prepare the ground. The frame and body, as also all other parts of the plow, are of iron and steel and so strongly made that it is powerful enough to cut furrows to the depth of from 25 to 28 centimeters (10 to 11 inches), even in heavy, clogging ground. The plow may also be fitted with underground looseners, which follow the plow and loosen the subsoil to as much as 40 centimeters (15¾ inches) in depth, but do not turn it over.

The iron frame of the tipping plow bears in the center shaft an arrangement on which are two main wheels of different diameters; these are adjustable perpendicularly and can be turned sideways. The adjusting or placing of the wheels is easily effected from the driver's seat by means of a spiral and wheel, so that the driver has the plow under thorough control. An electric motor is mounted on the plow frame. A spur wheel is wedged onto the motor's anchor shaft. The motion of the electric motor is transmitted from this spur wheel with the aid of an intermediate appliance to a roller with a chain wheel. The dimensions of this appliance, which is made of cast-steel, are so determined that the compass of the chain wheel receives a lineal speed of 70 meters per minute. The plow is, therefore, moved at this rate of speed across the field by means of the stretched-out chain, the links of which are 11 millimeters (seven sixteenths of an inch) thick.

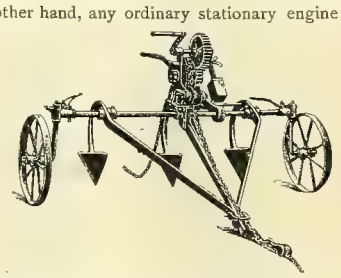
The chain is directed on to the chain wheel by guiding rollers in such manner that the tautly stretched chain end is constantly striving to raise the forward end of the plow as well as to press the rear end into the soil. This results in a steady and certain progression of the plow, enabling one with this implement to throw stubble from 10 to 15 centimeters (four to six inches) in height flat down, and to cut seed ridges.

To this end special peeling or shelling apparatus are constructed, which, after removal of the plowing arrangement, are affixed to the frame of the tipping plow in the simplest manner, the operation being easily performed in a short time by any plow driver.

The mode of proceeding to the next row of furrows and reversing the motion of the plow have already been explained.

ELECTRIC PLOW IN HUSBANDRY ON A LARGE SCALE.

For extensive farming operations the aim was to produce an electric plow capable of plowing four to five hectares (one hectare=2.47 acres) to a depth of 35 centimeters (13¾ inches) in 10 hours. As this requires about 35 horse power the ordinary locomobiles at hand are not available. But, on the other hand, any ordinary stationary engine is capa-



ELECTRIC PLOW IN GERMANY.—ANCHOR.

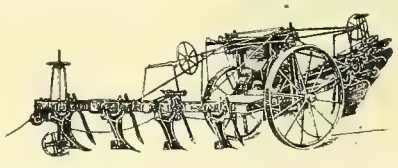
ble of supplying the elementary power necessary to run the dynamo machine under specially advantageous conditions. In fact, a properly fitted stationary engine will always work more economically than a portable engine, which will frequently burn up to 10 kilograms (22.046 pounds) of coal per hour per square meter of heated surface. The expense of water carting is also dispensed with.

As in the case of small farming the operation is comprised under three headings, viz., (1) the primary station, (2) the transmission of power, and (3) the plow, with electric motor.

(1) *The Primary Station.*—A dynamo machine of the requisite power is attached by driving belts to the stationary engine, being, of course, fitted with the necessary appliances for gauging the force of the current and the tension. Water power, where available in the necessary degree, may be very advantageously used to drive the dynamo machine, which can be done either by taking the power direct from the turbine or the water wheel, or by indirect beltings.

Here, again, it is essential that the elementary machine be prevented, by the introduction of suitable regulators, from too much variation in its revolutions. In like manner, when land is being reclaimed or improved, the stationary power must be used rationally. Thus, instead of the driving machinery of the pumping works, a dynamo machine should be used to produce the electricity, which can be conducted thence to any desired distance and for any wished-for purpose. It is only in such manner that a stationary engine can be intelligently turned to account in husbandry, inasmuch as uninterrupted use materially reduces the cost of creating steam, both per hour and per horse power. Moreover, as the electric current is available, the electric plow may, with the aid of electric light, be worked all night.

(2) *Transmission of Power.*—Two bare copper wires are carried from the dynamo machine to the field which is to be plowed, in like manner as telegraph wires are borne; namely, on poles. According to the size of the field, this connection by copper wire is either brought to the further end of the field, or where its length is 800 to 1,000 meters (2,625 to 3,281 feet), to the center division



ELECTRIC PLOW IN GERMANY.—FOUR-SHARE PLOW.

line of the field's length. Both the cables are affixed to the copper wires by nippers in such a way that they can be easily moved backward or forward. These cables are borne by the cable carriages and move forward and backward with the plow like a pendulum.

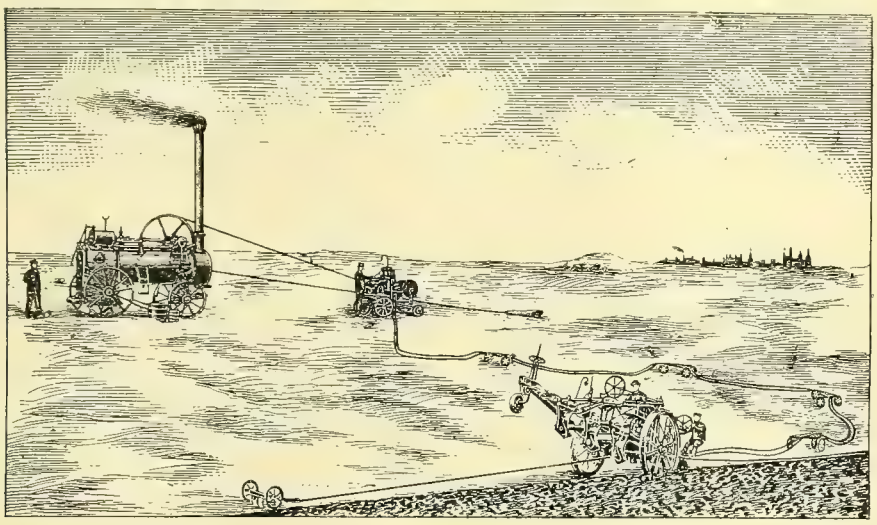
(3) *The Plow, With Electric Motor.*—A three or a four share plow is used for husbandry on a large scale. It is made on the same principle as the two-share implement, already described, only proportionately stouter. The frame of the tipping plow, which carries the cast-steel plowing contrivance, as its dimensions necessitate, is made of strong iron and carries a proportionately powerful electric-motor; this, by means of an intermediate wheel gear, sets a chain wheel in motion, which, in turn, draws the plow along the chain stretched across the field. Both the chain and its ground anchors are like those used with the two-share plow, only corresponding in power to the demands

made upon them. These anchors require two men to turn them. One of them may be the plow driver, while another man is stationed at each anchor to help in tipping the plow and shifting the anchor.

The reversing and resistance gear is easily handled from both of the driving seats, so that the driver, while guiding the plow with ease, has at the same time control of its motions. The depth of the furrows is determined by adjustable rollers. The transport of this tipping plow to the field is effected in exactly the same manner as already described.

WORKING EXPENSES OF THE ELECTRIC TILTING PLOW.

(1) *Two-share Plow in Small Farming.*—The experiments were made on heavy, binding, loamy clay soil near



ELECTRIC PLOW IN GERMANY.—SMALL FARMING.

Halle-on-the-Saale. A 10 horse power locomobile, fitted with a very exact regulator, was used, with the following results: Gauges showed a current tension of 110 volts and a current force of 60 to 80 amperes, an average of 8,000 watts), this being equal to the capacity of the locomobile up to 11 horse power. Two furrows 60 centimeters broad by 24 centimeters deep (23⅝ by 9½ inches) at each plowing. Power gauge varied between 600 and 700 kilograms (1,344 and 1,568 pounds), giving a mean of 650 kilograms (1,456 pounds) a resistanee of from 45 to 48 kilograms (100.8 to 107.5 pounds) per square decimeter (3.937 inches) of the cross section of a furrow.

At a progression of 0.9 meter per second, 7.8 horse power was made really useful, so that the loss of power between locomobile (11 electric horse power) and plowing (7.8 horse power), arising from transmission of power and tooth and chain friction, was 3.2 horse power. Compared with the loss shown by steam plows, this is exceedingly small.

Ignoring the purchase money for the locomobile, as most arms have one for thrashing purposes, the cost of working was:

| | Marks. |
|---|---|
| 1 fireman, 10 hours | 3.50 |
| 1 driver, 10 hours | 3.50 |
| 2 boys, 10 hours | 3.00 |
| Interest and sinking fund for working capital and repairs, excluding electric motor, on 6,750 marks, 20 per cent. per 100 days | 13.50 |
| On 1,750 marks (motor complete), 15 per cent. per 100 days | 2.62 |
| On chain, 50 per cent. on 480 marks, 100 days | 2.40 |
| Fuel, 400 kilograms at 2.25 marks | 9.00 |
| Lubrication of locomobile, dynamo machine, electric motor and plow | 2.00 |
| 2 loads of water | 4.00 |
| Total | 43.52 |

With eight acres in 10 hours, on heavy soil, with a depth of 24 centimeters (9.24 inches), the cost would be 5.44 marks ($1.29) per acre, as against 12 marks ($2.74), the cost of doing the work with oxen. In comparing with the cost of the latter, even with a depth of furrow of from 30 to 35 centimeters (11.8 to 13.8 inches), the electric plow is still by far the cheaper.

One boy drilled to the work would suffice. In many positions, the locomobile could feed the boiler from an automatic pump. These two items would reduce the daily cost by 5.50 marks ($1.31), bringing it down to 4.80 marks ($1.14) per acre.

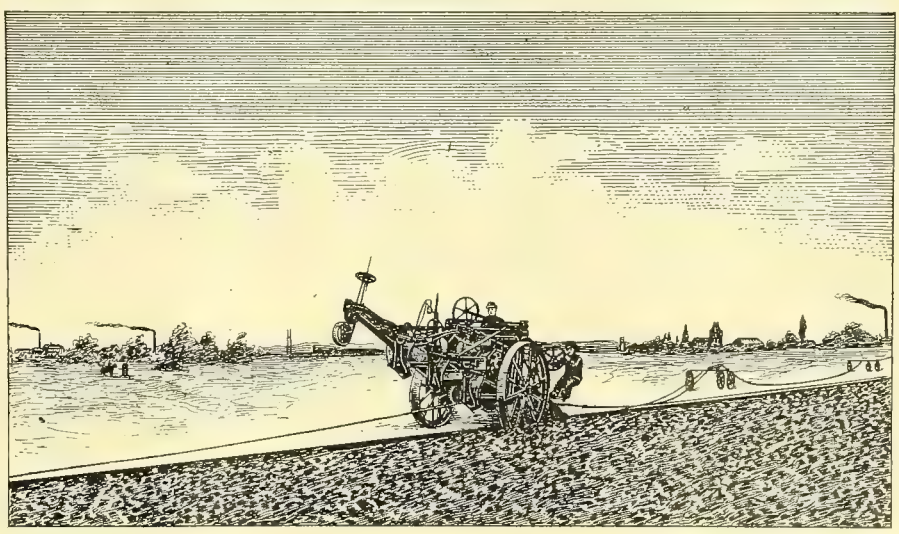
The economy effected is so self-evident as to render argument superfluous.

(2) *In Large Farming.*—A comparison with the steam plow is necessary in order to make the following statistics intelligible:

The cost of steam plowing to a depth of 35 centimeters (13.8 inches), evidently with variety in character of soil, is stated by two German authorities at 39.36 marks ($9.37) and 46.72 marks ($11.12), respectively, per hectare (2.47 acres), whereas both give the cost of plowing with oxen at 50 marks ($11.90) per hectare. And, moreover, a steam plow costs 60,000 marks ($14,280), as capital to be provided for.

As against this, the large electric plow shows: (1) Cost of stationary steam engine (semi-locomobile), complete, 40 to 45 horse power, 13,000 marks ($3,094); (2) dynamo machine, including foundations and driving belts to produce 33,000 watts per hour, together with the necessary gauges, 5,000 marks ($1,190); (3) electric conduits, complete, including labor, etc., three kilometers (1.86 miles) in length (in many districts poles would be cheaper), 4,500 marks ($1,190). Making the expenses (sinking fund, interest, wages, coal, etc.) 34.94 marks per day of 10 hours, or 3.494 marks (83 cents) per hour for 3,300 watts, not including transmission loss, which brings the cost up to 11.7 pfennigs (2.8 cents) per 100 watts.

The results hitherto obtained show that, with a motive power of 33,000 watts, it may be guaranteed that four



ELECTRIC PLOW IN GERMANY.—EMPLOYED ON LARGER SCALE.

square hectares can be plowed 35 centimeters deep in 10 hours. This would show:

| | Marks. |
|---|---|
| 3 × 11.701 | 35.10 |
| Wages, two hands | 10.00 |
| Sinking fund, interest, and repairs, 20 per cent. on the fitting up of the complete plowing gear, without the chain, capital sum 10,300 marks | 2,060.00 |
| Chain, 50 per cent. on 850 marks, its cost. | 415.00 |
| Total | 2,475.00 |
| Taking an average of 100 working days of 10 hours per annum this would show, per day | 24.75 |
| Total cost per day | 69.85 |

Or, in round figures—four hectares in 10 hours—per day, 70 marks.

It is thus evident that the working expenses of the electric plow for extensive husbandry amount to less than half of those incurred in working the steam plow. This contrast is readily explained, for the capital sunk in plant is only one-third of that required for the steam plow; the expenses connected with the generating of power are materially lower than is the case with the steam plow, in which a very considerable surplus power has to be raised in order to work the pulleys and brakes and to overcome the stiffness of the rope and the expensive transport of water is herein entirely done away with.

## Sigmund Schuckert.

On September 16th after long and painful suffering the founder of the Schuckert business enterprises, Sigmund Schuckert, expired at his home at Nürnberg, Germany.

Sigmund Schuckert descended from a family long resident in Nürnberg and was born in that city October 18, 1846. He received a practical mechanical training and after the completion of his apprenticeship he left his native town and worked during a period of five years in the cities of Stuttgart, Hanover, Berlin and Hamburg. In May, 1869, he visited America and he made the acquaintance of Edison. For four years he worked in New York, Baltimore and Philadelphia and in 1873 he went back to Europe and laid the foundation for the extensive business that was afterward developed. It was then that he constructed his first dynamo, which was used principally for electro-plating. In 1875 he had the gratification to start his first lighting station. Twenty years ago last month, he operated the first arc lamps in Nürnberg. The model, later known as Schuckert's "Flat Ring Machine," showed a high point of technical knowledge. What gave the Schuckert enterprise the greatest elevation, was the continuous current arc lamp, which he developed. The extension of the factory on account of the introduction of the arc light with conical core, was imperative. In 1883 he employed 100 people at his factory, in 1886 double that number and at the time of his death there were 2,000 names on the pay-roll.

With no less success did Schuckert take hold of the development of central station apparatus and details of equipment. How readily he grasped the situation relative to new inventions, was exemplified in connection with the searchlight, on which he worked untiringly till he was congratulated by the military authorities, and it was with great pride that he related how on one occasion Werner Von Siemens, who always was ready to acknowledge merit in others, held out his hand saying, "Siemens bows to Schuckert." He watched with intense excitement for the time to come when the largest searchlight in the world would be exhibited at the World's Fair, Chicago.

With all these results Sigmund Schuckert retained a modesty which became proverbial. Schuckert was always on the best of terms with his employes and went by the name of "Father" among them.

## Expert Workmen Needed Nowadays.

There is more and more demand, with higher and higher remuneration, for skill, and less and less demand, with relatively lowering remuneration, for unskilled labor, says the St. Louis *Republic*. In other words, modern machinery and economies are in want of high-grade skill, while they cannot afford to deal with any kind of inefficiency. There is a dearth of qualified experts in all branches of trade and even in the professions. The slovenly and slow cannot do the work. Twenty years ago anybody could drive a street car. To-day the motorman must have the head and hand of an engineer. During the civil war a ship's commander could be made in a few months from a cadet. To-day he is unfit for his post unless he has had scientific training of a severe kind. The law is working on every farm and in every store. The age expects each man to turn out a larger product than did the man of 1870.

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## HIGH WATER MARK

CIRCULATION, 16,630.

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IT seems as if there was a good deal of misdirected energy in the struggle at White Plains, N. Y., between the local trolley company and the Harlem Railroad company. The aim of the former to have its road in readiness to accommodate visitors to the county fair was a laudable ambition, but it seems that if arrangements had been made ahead and all cause for misunderstanding removed, the trolley company would have been better off. All of these conflicts are senseless and annoying to everybody participating in them. Besides the spectacle is not at all edifying.

ADDITIONAL interest is given to the suggestion that the Chicago drainage canal project include an electric power transmission plant by the announcement that one of the first questions to come before the new board of sanitary trustees after election is the completion of controlling works at the Lockport end of the drainage channel. The distance from the present terminus of the main channel to Lake Joliet is about eight miles, which will be the length of the controlling works. The route passes directly through the city of Joliet. Several electrical concerns, it is reported, have been figuring on the cost of utilizing the Joliet controlling works for transmitting electric power to the suburban manufacturing districts around Chicago, and now it is claimed one big company has made an exhaustive investigation of the plan and has pronounced it feasible from a commercial standpoint. Ex-Chief Engineer Williams of the sanitary board has made several reports tending to show that the district would be justified in a large investment for the development of water power. His views were overruled by a majority of the retiring board, for the principal reason that the funds at command would barely complete the channel, and that the additional millions for the development of water power could not be raised in the lifetime of the present board. When the suggestion was first advanced comparatively little attention was given it, but now it is receiving serious consideration and there is a probability that something will come of it, although hardly in the line which the present advocates anticipate.

MANY who will attend the Montreal convention of the American Street Railway association will experience for the first time the hospitality of a Canadian city. They will see more, too, of the Canadian character, which contains much to admire, and they will have an opportunity to study the methods of doing business in what is in many respects the greatest of Canadian cities. They will be impressed by the thrift of the people, the enterprise and public spirit shown on every hand, and if they desire to examine for themselves into the resources of the country they can gain much information on this occasion. They will find, too, many imposing buildings worthy of inspection, works of art and institutions of learning on a scale that is hardly appreciated in this country. Besides, they will find that our Canadian friends have learned to enjoy life, and if they are so fortunate as to gain admittance to the home circle, they will find a cultured company to entertain them. No wonder that those who are familiar with Canadian life and character and the resources of that wonderful country are eager and anxious for an opportunity to welcome it into the Union.

ALTHOUGH the subject of applying electricity to agricultural work has often been considered in this country, and experimental work has been conducted on a small scale, there has been comparatively little practical advancement made. This has been due in a measure to disinclination on the part of farmers to encourage the movement by lending financial aid or taking active part in the work. The American farmer is thrifty and in a measure he is progressive according to his own ideas, but he is much more willing to take advantage of a labor-saving device than to assist in its development. If it can be shown that plowing can be done by electricity at reduced cost and that this work can be done quicker and better by the aid of electric motors than by the employment of manual labor and animal power or by steam plows, the big farmers of this country will not be slow to take advantage of the improvement. The report received at the state department at Washington from the United States consul at Leipsic describes in detail the working of the electric plow at Halle-on-the-Saale, Germany, which encourages the belief that there is a big field here awaiting development. Reference has already been made in these columns to these experiments, but this is the first time that a detailed explanation, accompanied by sketches showing the practical application of the system, has been presented. In this country more attention has been given the subject by inventors than by farmers, but now that German agriculturists claim that the idea is not ony practicable but economical, we may look to an awakening of interest in the subject on this side. It is pointed out that where electricity is used, the work can progress continuously, electric lights being utilized to illuminate the fields by night while the electric plow continues its operation. It is added that in Germany the application of electricity is to be extended to other farm work, including the digging of potatoes and beets. Surely the American farmer should not be behind those of Germany in such matters.

IN Mr. Bonney's European trip he was impressed by the fact that the street railway companies provide better accommodations for passengers than do the American companies; for instance, each person paying fare is entitled to a seat, the same as on steam railroads, and the companies provide enough cars to take care of the people during the busiest portions of the day. It will be hard to introduce such methods in street railway practice in this country, as any one familiar with the conditions that prevail in large cities here will readily understand. In the first place the people will not wait for seats in street cars like their slow-going friends across the water. They are in too much of a hurry to reach their destination and they will persist in climbing on the first car that passes, even though they have to hang onto a strap or stand on the steps of the car on a cold winter day. No matter how much leisure they may have they are always in a hurry when they wish to ride on the street cars. Of course the street railway companies take advantage of this fact and crowd the passengers like sardines. Another subject that Mr. Bonney investigated while in England was the ownership of plants and the arrangements between different companies using the same rails in the street. A method of building street railways, which is now very popular abroad, greatly lessens the cost of installation to the promoting capitalist. In many instances, it is reported, the city puts down and owns the tracks, which the operating company leases for 21 years, and at the expiration of that period the lease may be renewed or the city may buy the plant and rolling stock at an appraised valuation. This is another feature that Mr. Bonney wishes to have introduced in this country, and the present litigation with the Chicago City Railway company over the right of the latter corporation to monopolize the streets in which its tracks are laid is only one of the steps which Mr. Bonney's company has decided upon as a means of bringing the question prominently before the public.

TOO much encouragement cannot be given to the men and the women who are devoting their time, their money and their energy to the scientific investigation and study of electro-therapeutics. They are deserving of success and of such honors and rewards as a grateful public can bestow upon them. Many able minds are occupied with the subject, and many of those who are engaged in this investigation have been obliged to make great sacrifices in order to follow their studies in this line. An old practitioner explains this by saying that a physician engaged in general practice cannot find time to devote to these special studies. The men who engage in these investigations must throw off all other ties and devote themselves entirely to study and experimental work if they hope to make any progress. The men who do not follow this course, but who, without sufficient preparation, attempt to apply electricity in the practice of medicine are dangerous men and are unworthy of any confidence. There are too many of these latter, we are sorry to say, and because of their quackery there is a general disinclination on the part of many reputable physicians to employ electricity in any way in medicine or surgery. But these quacks are coming to be known and to be rated properly by the community, and a distinction is being made between them and the men of scientific attainments whose views are entitled to respectful consideration. The president of the National Electro-therapeutic society recently said that "though electricity had long been used as a remedial measure, yet its marvelous attributes so early attracted large numbers of charlatans and impostors who made use of it to impose upon the credulous, that scientists, loth to be classed with humbugs, refrained from giving serious thought to its development." Now, however, that the subject has been taken up by learned men who have attained standing and influence in the medical profession, we may hope for marked advancement in this special line of study. The several organizations can contribute to the progress of this work by exchange of ideas and the establishment of an authentic record of each case that yields to treatment of this kind. The public generally and scientists particularly are interested in the progress of this work.

OBJECTION has been made by the health department of Chicago to the instructions placed upon the subscribers' outfits by the Chicago Telephone company, directing users to "place the lips directly within the mouthpiece of the transmitter." Probably it would be more accurate to say that the health commissioner made objection. That official is not a doctor, nor does he make any pretensions to scientific attainments. He is merely a politician and his communication to the telephone company discloses the fact that he is endeavoring to make a reputation in a cheap way. His blustering demand for the removal of what he was pleased to call "this filthy and disease-breeding instruction" does not voice the sentiments of the leading practitioners of the city. Evidently Mr. Kerr does not know that when the pattern of the telephone mouthpiece now in use was under consideration nine years ago the matter of its probable unhealthfulness was thoroughly investigated by scientists of acknowledged ability and standing before it was adopted by the American Bell Telephone company. It has been generally conceded that there is now no more occasion for alarm than there has been during the last nine years, and in that time no one has shown that the transmitter was a "disease breeding" instrument. An officer of the telephone company explained that in the effort to improve the telephone service of the city, the company found that some of the methods used in handling the telephones were such that it was difficult and often impossible to give the service desired. No one cause brought about as frequent complaint as the habit of standing from one to two or three feet away from the transmitter and then talking into it in a very loud tone of voice. As far as possible the company's employes endeavored to explain the best method of using the instrument by personal calls, but later the notice referred to was printed. This asks that the user place his lips within the mouthpiece of the transmitter, not that he should touch the mouthpiece in any way. Some physicians think that there may be danger of spreading contagious skin diseases by placing the receiver close to the car, but thus far there have been no authentic cases recorded. So far as spreading disease by means of the transmitter is concerned, responsible medical men say that there is no reason to be alarmed.

## Electrical Utilization at Portland, Ore., of the Power of the Falls of the Willamette River.

The installation shown in the cuts was made by the Portland General Electric company, of which F. P. Morey is president. The company owns the entire water power of the falls on the Willamette river at Oregon City, 12 miles above Portland, which, with a head of 40 feet, has a minimum capacity estimated at 50,000 horse power. Part of the power has already been utilized by factories and mills erected near by, and in addition to these an electric station, erected some years ago, has supplied current for lighting the streets and dwellings of Portland and for operating an electric street railway between Oregon and Milwaukee, seven miles away, the direct current and high frequency alternating systems being used.

In order to take advantage of the power of the falls the Portland General Electric company has constructed the first part of an extensive station on the west side of the Willamette river, opposite the city of Oregon. The part constructed is one-quarter only of the building, which is being put up in sections. Twenty sections will complete the building; five are already built and foundations are now being laid for the remainder. The ultimate generating capacity of the station will be 12,800 horse power.

In addition to the land covered by the station, the Portland General Electric company has purchased about 1,600 acres in the vicinity. It also controls the canal and locks on the west side of the river, constructed to allow of the passage of vessels past the falls into the navigable waters above, extending 75 miles inland.

The station building is of concrete, stone, iron and brick and when finished will have a length parallel with the river of 364 feet. The water is taken from the canal, led through an extensive hydraulic installation and discharged into the river below on the other side. The water wheel plant is from the works of the Stilwell-Bierce & Smith-Vaile company of Dayton, O., and consists at the present time of three units, each consisting of a pair of vertical cylinder gate improved Victor turbine wheels, 42 inches and 60 inches in diameter respectively. The larger wheel is an auxiliary to be brought into service only at periods of excessive high water, which the records show occur about once in every five years. The smaller wheel runs at a speed of 200 revolutions per minute and the larger at 100 revolutions per minute. Both turbines are set at the same level and each carries a pulley; that of the 60 inch wheel being fixed to the generator shaft. When the large wheel is in operation the two pulleys are belted together, the smaller wheel is disconnected and the large wheel drives the generator at a uniform speed of 200 revolutions. When the smaller turbine is operated alone the belt lies upon a shelf surrounding the pulleys.

The weight of the vertical shaft with the armature is about 33,500 pounds and to carry this a system of extra bearings is introduced, one of the ring thrust type and the other a hydraulic oil bearing, both supplementing the ring bearings on the armature shaft. They are inclosed in cases filled with oil delivered by hydraulic pressure, and are surrounded by water jackets.

The length of the generator shaft is 29 feet, and 8⅜ inches in diameter. It is not a continuation of the shaft of the wheel but is coupled to it by means of a disk coupling, which allows of a certain free movement up and down of the generator shaft. The shaft of the 60 inch wheel runs from the coupling to a bearing set in the floor of the station. Both wheels in each section are controlled by hand wheels and both are regulated by the same governor. The belt tightener is also controlled from either floor by a hand wheel.

The water is admitted to the penstocks from the upper canal by means of a headgate operated from a platform on the canal side of the station. Each penstock is 10 feet in diameter and is constructed of riveted steel plates. Each wheel has its own flume, the water passing first through the large flume of the larger wheel to the flume of the smaller wheel, whence it passes through a tube into the tail race. In addition to this turbine equipment, an auxiliary power equipment has been furnished, consisting of a set of pumps, including a hydraulic pump for supplying oil to the thrust bearing cylinders and a duplex water pump to circulate the water in the cylinder water jackets. They are operated by two 15 inch horizontal turbines enclosed in the same flume.

For the operation of the exciters, a further pair of vertical turbine wheels has been installed, each 48 inches in diameter, driving the generators by a similar system to that already described for the operation of the main machines.

The complete power plant will consist of 20 three-phase generators and two direct current generators, acting as exciters. The total capacity of the station, therefore, will be 12,800 horse power, divided into 20 units, each one independent of the other.

In order to obtain the best results from the power at its disposal, the Portland General Electric company selected the three-phase system of electrical power transmission as developed by the General Electric company. One feature of the Portland installation is the employment of large blocks of power for street railway service, involving the transformation of the polyphase current sent over the line into direct current for railway circuits. The frequency is 33 cycles per second, selected on account of the large amount of power which it was necessary to convert from alternating into direct current. The current is delivered directly to the line without first passing through transformers and when it reaches Portland is transformed down to a potential of 400 volts. For the power service, the step-down transformers are connected to rotary converters which will deliver a continuous current of 500 volts for street railway service, as well as for the operation of stationary motors. Induction motors will also be used directly connected to the secondaries of the step-down transformers when this can be done to advantage.

The five sections of the building already erected are occupied in the following order: The first section contains the pumps and the accumulators for the complete station; in each of the three following sections is one three-phase alternating current generator of 450 kilowatts, or 600 horse power capacity, and the fifth section contains two 250 kilowatt continuous current generators used as exciters. Each exciter is capable of exciting all of the 20 three-phase generators, and the second has been set up as a reserve in case of accident to the first. At present, one is furnishing direct current to the street railroads in Oregon City. When the station is complete, the exciter section will be removed from the fifth section, which it occupies at present, and will be placed in the center section of the building, where the switchboards will also be erected.

The generators are of special design and are set upon the floor of the station, the armatures revolving in a horizontal plane, with one bearing at the floor line and another on top of the armature underneath the collector rings. Each generator has 20 laminated poles. The armatures are a little over seven feet in diameter and are about two feet high. These armatures are constructed to deliver current directly to the line at a working potential of 6,000 volts effective pressure without the intermediation of step-up transformers. On account of this high voltage unusual precautions were necessary to perfect the insulation of the armature coils to avoid leakage to the ground. The armatures are wound with flat wire and each of the coils is divided into sections, each section being separately insulated. The field coils are wound for excitation of 500 volts continuous current and each has been subjected to a test of 5,000 volts alternating. The regulation in these machines has proved singularly good, the increase from no load to full load being comparitively moderate.

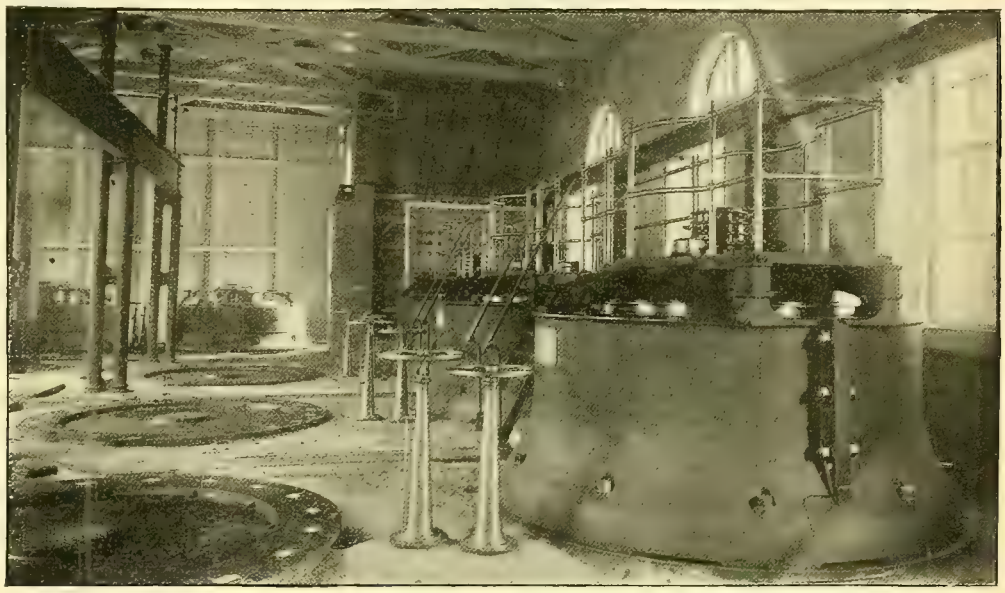
From the dynamos the leads are run to floor connectors and pass underneath the floor to the switchboard. The concrete floor is laid over them and thorough protection guaranteed.

The exciters are set up to allow of the armature revolving in a horizonial plane with one bearing only at the floor line. The construction of these exciters is almost identical with the General Electric multipolar type of railway generator, and each has a capacity of 250 kilowatts at 125 revolutions per minute.

The high tension switchboards are built of native marble and the panel method of construction is followed throughout. Each panel carries a double pole main switch for the high potential circuit and a double pole double throw switch for the exciting circuits. It also carries a rheostat for the control of the excitation of each machine and a single throw switch opening the circuit through a set of seven 32 candle power 110 volts. In addition the board carries a current indicator for each line and one for the exciting circuit, and a potential indicator with station transformer placed at the back. The upper part of each panel consists of a set of plug connections for coupling the machines in parallel or for direct line connections from each generator.

The exciter switchboard consists of two panels of Tennessee marble with a special switching panel between them. By means of this switching panel current for the railway service in Oregon City can be obtained from either exciter, or the two exciters can be coupled in parallel or the outgoing railroad current can be used for excitation purposes and the balance from the exciters can be used for other work.

From the generators the current passes directly to the line through the switchboard. The line is 14.3 miles long, a separate circuit being installed for each machine. It passes through an undulating country following the course of the Willamette river as closely as possible. The poles upon which the three-phase wires are strung also carry a number of wires for the 5,000 volt continuous arc current from the old transmission station, as well as the wires over which the old system of lighting with high frequency 5,000 volt alternating current is effected.



ELECTRICAL UTILIZATION AT PORTLAND, ORE., OF THE POWER OF THE FALLS OF THE WILLAMETTE RIVER. —INTERIOR OF STATION SHOWING THREE-PHASE GENERATORS AND DIRECT CURRENT EXCITERS.

The loss in the long distance transmission line is calculated at full load at about 11 per cent.

The sub-station to which the high frequency lines are brought, is a two-story building at the corner of Seventh and Alder streets, covering a space of 40 by 100 feet. The lower floor is divided into three rooms, one containing the transformers, the second the rotary converters, the other being used for a repair shop, lamp and meter room. The upper story of the building is occupied by the offices.

In the transformation room at present are the necessary transformers for the three units already installed—45 transformers in all. The receiving end of each line is connected to a bank of 15 transformers per generator, five being placed between each pair of wires of the three-phase system. The transformers are mounted on an iron rack five transformers high and three wide, and foundations are already laid for six additional units. Each set of five transformers is connected to the primaries in series, and to the secondaries in parallel, although in the transformation of the three-phase current two sets only are necessary. For the large units, with high voltages, however, as employed in the present installation, it is desirable to have a large number of transformers banked. The bank, therefore, is divided into three sets instead of two, so that each group may act as a reserve to the other two sides, enabling two-thirds of the power of each generator to be delivered even if the transformers on one leg of the circuit have to be disconnected, nor is the balance of the system affected by this change of connection. The transformers regulate at a little over one per cent. variation of the secondaries from no load to full load. The transformers are of the standard General Electric sub station type, having numerous air passages between successive bunches of iron laminæ and be-

tween the coils, so that they may be cooled by artificial ventilation. This enables the transformers to be worked at a high output of efficiency and yet remain cool. The distribution of light from the secondaries is effected on the Edison four-wire system, which allows of a large territory being operated from one transformer station, and which also allows of the working of synchronous and induction motors from the lighting mains. The four-wire system is worked at 1,000 volts between wires, and by means of feeder regulators a variation of 4 per cent. in either direction is covered.

As already mentioned the direct current for the railway service is obtained by conversion from the three-phase alternating current. This is effected by means of rotary transformers, a type of machine which the General Electric company has brought to a high state of perfection. Two of these are at present installed in the sub-station and space has been left for an additional three. The capacity of each converter is 500 horse power delivered to the bus-bars of the continuous current switchboard.

The long distance transmission lines for this railway service, as in the case of the lighting circuits, are connected to step-down transformers, transforming the current from 6,000 volts on the line to 400 volts at the secondaries. The secondaries are connected to the three collector rings on one side, and the current is thus brought into the armature of the rotary converter. The alternating current at 400 volts is then converted in this machine into direct current at 500 volts at no load and 550 volts at full load delivered from the commutator side. The rotary converters are arranged for self regulation, the voltage on the direct current side compounding with the same regularity as that found in the best direct current dynamos, despite the varying losses on the long distance line and the varying armature reaction in the rotary converter. This regulation is entirely independent of the generator which receives constant excitation at all loads. The shaft of the rotary converter is extended 12 inches beyond the bearing of the alternating current side to take a small pulley from which any small machine or an arc dynamo may be driven.

It is a noteworthy fact that in spite of the long transmission line, and the increasing load on the generator, the potential supplied to the railway lines steadily rises as the load is increased.

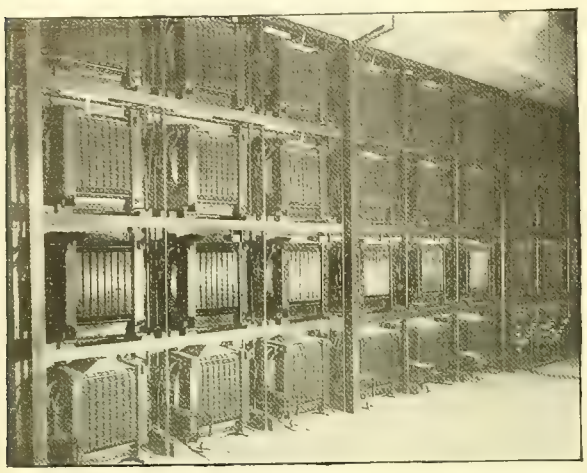
Each rotary converter has a capacity of 400 kilowatts. It is an eight-pole machine making 500 revolutions. The armature is iron-clad, carrying at one side a commutator and at the other three collector rings.

From the rotary converters the wires are taken to the power switchboards. Each converter has two panels, one for the three-phase current and one for the continuous current. The alternating current panel carries two double pole switches, one for connection to the converters and transformers and the other to connect the converter to a set of common bus-bars. An additional main switch is provided to connect the rotary transformer and the panel itself, which carries also a set of fuses, three current indicators and a potential indicator with a transformer reducing the potential from 3½ to 1. The continuous current panel is of the standard direct current railway type with automatic circuit breaker, and a current indicator added for the fields of the rotary transformer. The panels may be coupled in parallel on both the alternating and continuous current side.

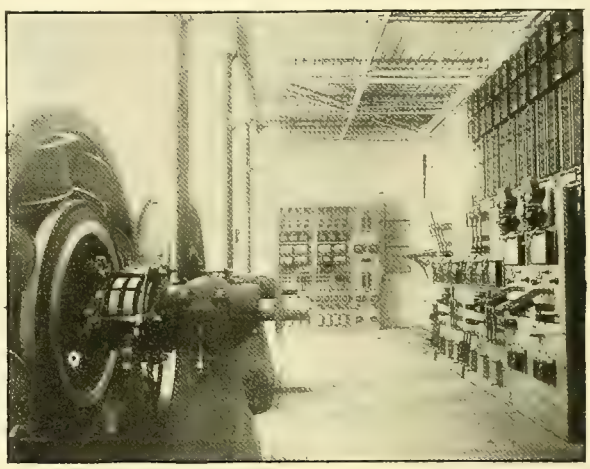
The lighting switchboards in the sub-station consist of one panel for each leg of the three-phase system. The secondaries from the transformers are entirely independent and the panels carry fuses and two four-pole switches for coupling the feeders directly either to the corresponding transformer unit or to the bus-bars and the switches for the operation of the feeder regulators. A current indicator is placed on each side of the four wires and three potential indicators between the four wires. On top of the switchboards are placed the main switches for opening the different feeders, and each panel is provided with ground detectors and lightning arresters.

At present the lighting rom the three-phase system is used for large buildings, containing several hundred lights each. They are close to the city station and this distribution can be readily handled at about 400 volts. For the outlying and residential districts the high frequency apparatus with individual transformers will still be employed. Continuous current will be furnished to the railway and to the stationary motors already installed, but new motor installations will be made with the three-phase motors, which will be run straight from the three-phase switchboard, in parallel with the rotary transformer.

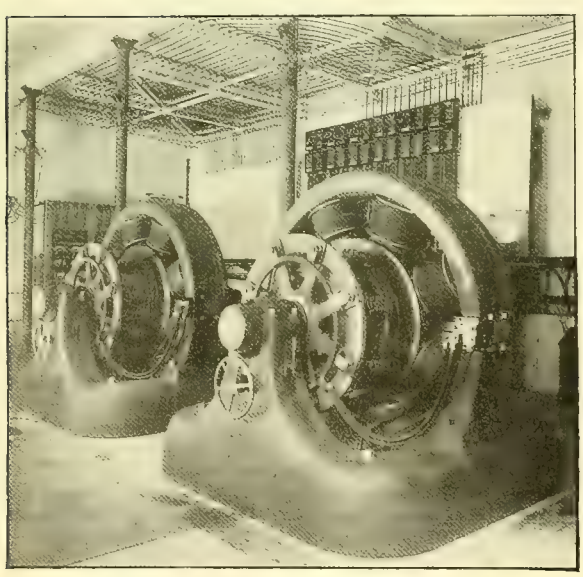
The direct railway current will be carried to the East Side railway station by means of cables under the Willamette river and this distribution will reach as far as Milwaukee, where connection will be made in parallel with the 600 volt service from either station A or station B at Oregon City. The loop from Oregon City to Portland and back will thus be as follows: Beginning at Oregon City with 33 cycle three-phase current at 6,000 volts 14.3 miles will be traversed as far as Portland; the current will then be transformed to 450 volts alternating, and passing through a rotary converter, issue therefrom at 600 volts continuous, which will be transmitted eight miles to Milwaukee and connect with the continuous current from Oregon City.



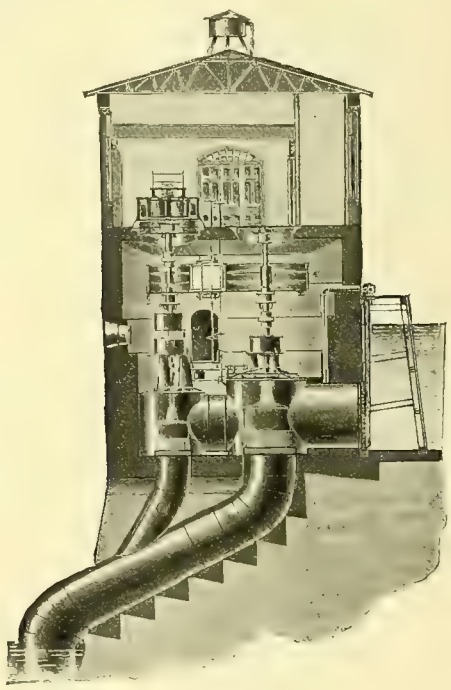
Reducing Transformers.



Three-phase or Receiving Side of Rotary Converters.



Direct Current Side of Rotary Converters.



Section through the Station.

ELECTRICAL UTILIZATION AT PORTLAND, ORE., OF THE POWER OF THE FALLS OF THE WILLAMETTE RIVER.

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It is announced that the Ogden Street Railway company has secured its right of way over all the streets desired on the West side, Chicago. This road will connect with the Cicero & Proviso electric line. It was said that one-half of the new road would be ready for operation in two months, and that the remainder would be completed by next May.

## Electricity as a Factor in the Practice of Medicine.

The two-days session of the National Society of Electro-therapeutists, held at Boston recently, was a most interesting meeting as a whole. About 30 papers were presented by eminent physicians of the homeopathic school, some of them of particular interest only to medicos, but others well worth listening to or perusing by practical electricians. The order of business was classified and divided into bureaus as follows: "Bureau of General Electro-therapeutics" of which A. K. Crawford, M. D., of Chicago was chairman; "Bureau of Diseases of the Nervous System;" "Bureau of Electro-surgery;" "Bureau of Electricity in Gynecology" and "Bureau of Diseases of the Eye, Ear and Throat."

The address of the president, William L. Jackson, M. D., who is recognized as one of the most advanced physicians of the Roxbury district, was an interesting and carefully written paper on the subject of the "Development of Electro-therapeutics and Its Relations to the Practice of Medicine." Dr. Jackson said:

When we stop to reflect upon the marvelous advance our civilization has made in the last 20 years, we are struck especially by the development of that force which has long been familiar, but whose practical possibilities we had no conception of until recent years. During the years which have elapsed since the Centennial exposition, we have seen such wonderful development of this agent which we call electricity, and in so many different directions, that we can only find a parallel in the marvelous magic of the Arabian Nights.

Though electricity has long been used as a remedial measurs, yet its marvelous attributes so early attracted large numbers of charlatans and impostors who made use of it to impose upon the credulous, that scientists, loth to be classed with humbugs, refrained from giving serious thought to its development. But recently great advances have been made for reasons which it may be worth our while to consider. The newly awakened interest of scientific men has led them to renewed investigation and consequently we now understand better the nature of electricity. Instruments have deen perfected and are now commonly used by practical physicians in their daily work. There is a more uniform standard of measurement which enables specialists of different countries to compare results. Electricity as a therapeutic agent is now used by physicians well versed in electro-physics and electro-physiology.

Much insight has been gained into the effects of electricity in disease by the careful and accurate reports of cases from which one can form a just estimate of appropriate methods and dosage to be used. Most prominent among those who have advanced the science in this respect is Apostoli, who gives us models of exact and complete histories.

All who have devoted themselves to this subject in the last few years must recall their disappointment at the insufficient, obscure and unsatisfactory indications for treatment given even by books from the pens of brilliant men like Erb. de Watteville and Beard and Rockwell. Formerly we had only three or four text-books, but to-day there is at our command quite a library, mostly written within the last four or five years Of especial advantage to the electro-therapeutist is the recent "International System of Electro-therapeutics" which contains the most advanced thought and methods of many leading authorities. All these factors combine to give electro therapeutics a place in medicine unknown to it formerly, and to make it the duty of every physician to investigate the subject, for if disease can be cured more safely, surely and speedily by electricity than by other measures, he would be remiss in his great responsibility if he did not either make use of it himself or advise its use by some one who is familiar with it.

Just here I want to make emphatic the feeling of all electro-therapeutists, that this remedy is not a cure-all, that it has well marked limitations yet clearly defined indications for use. It has a sphere of usefulness all its own which every one must recognize. Because a patient has received no help from an application of electricity, it does not follow that his condition may not be benefited by it. Disease does not always yield at once to medicine, and why should we expect more of electricity? In many diseases a long course of treatment is required before any result is obtained. Take for instance, a case of infantile paralysis where the disease has been present for a long time before coming under treatment. In some of these cases most satisfactory results have been obtained by steadily following up the treatment for from one to two years. Too common a mistake with those who do not fully understand it, is to apply it in unsuitable cases and at improper times, to the disappointment of the patient and the discouragement of the physician, when this might have been prevented by more careful discrimination in the selection of the form of current and a proper consideration of the dose.

We have at our command a number of currents from which to select and it requires considerable judgment, based on extensive experience, to decide whether the static insulation, breeze or sparks, the static induced current, the galvanic, the faradic or the sinusoidal is the most suitable. Not only the kind of current, but also it direction, the pole, and the dose, should be taken into consideration and will require as much skill as the selection of a remedy.

Electro-therapeutics is no longer the careless, haphazard practice it used to be, but is developing to the state of an exact science having clearly marked indications for application to different diseases and requiring nice discrimination. The power to successfully differentiate between methods of treatment can only come from close study of the physical effects of the current and careful observation of its effects upon the human subject. The electro-therapeutist should receive as thorough training for practice as the surgeon, and he will get the best results who is enthusiastic enough to have mastered the subject, and not the half-believer who occasionally dabbles in its use.

That the profession is awakening to the advantages of electricity, Dr. King showed last year in his presidential address before this society, when he stated that the number of electro-therapeutic chairs in the different medical colleges has greatly increased. Moreover, the interest aroused among the fraternity has induced the formation of two flourishing electro-therapeutical societies in this country, as well as smaller local organizations.

The underlying object of this society is to perfect our knowledge of electro-therapeutics by a mutual exchange of results and ideas. I venture to say that no one in the society claims a complete understanding of the subject, but all feel that they may receive valuable suggestions from even the youngest beginner. For this reason we welcome to our ranks all in good standing in the profession who desire to make use of electricity. Everyone can help the cause by keeping careful records of his cases, his method of administering the current, the doses employed, and finally the results obtained. If each member of the society would do this and would report experiences whether satisfactory or not at our meetings, we should have the data for developing and advancing this science to the place where it belongs in the practice of medicine. It should be the aim of every one of us to perfect our present knowledge, and to make careful investigations and experiments in new fields, not for our own advantage as individuals but with the higher aim of benefiting suffering humanity.

Already electricity has a wide sphere of usefulness. Even its physical properties, as heat and light, assist us. By means of its light we obtain a knowledge of internal organs and parts by which we are enabled to treat them far more satisfactorily than we could without its aid. It has been proved that the effect of the electric light on plants is to stimulate their growth and improve their condition. This being a fact, it is reasonable to suppose that it might have the same effect on animal life, and, indeed, recent experiments with the electric light bath upon the bodies of patients have shown this to be the case.

Its power to produce heat is of especial advantage in surgery where the cautery is used to destroy abnormal tissue. The electrolytic effect we use for the destruction of morbid growths, disfiguring marks on the face and excessive growth of hair. By means of its cataphoric action, we can introduce medicines into the system. By its catalytic effects we may increase the circulation of a part, cause a change in the arrangement of the molecules and even cause absorption of growths or inflammatory products. It is in diseases of the nervous system that it finds one of its most useful spheres of influence. Not only is it valuable in determining the site of disease, but it gives us most helpful aid in neuralgic affections and in paralysis. In neurasthenia we place especial reliance upon it in connection with general treatment. In gynecology, also, its power has been often proved. In spasmodic affections, in congested conditions, in exudations, in lack of tone of muscles of the pelvic organs and even in tumors, good results may be expected in properly selected cases. In surgery the electrolytic and cauterizing effects of the current can oftentimes be most beneficially made use of. Above all, it is one of the safest and best general tonics at our command.

To sum up, electricity may be fairly claimed to be one of the most useful adjuvants in the practice of medicine. We do not intend to displace other methods of treatment which may be better in certain cases. The electro-therapeutist desires to walk hand in hand with his brothers in medicine, helping them in places where they are powerless, but leaving to the surgeon, the genecologist, the neurologist, each his legitimate work and asking only for recognition in those cases which can be better treated by electricity than by any other method.

In view of the wonderful development of this science during the last 20 years, who is so daring as to predict the limitations of this marvelous force in the treatment of disease? It requires no great skill at prophecy to foretell that in electricity medicine of the future will have its most helpful ally.

As has been intimated, the papers read covered a wide range of disease and physical disorder. Several were contributed from abroad, notably by the famous Dr. Apostoli of Paris, and Dr. Cowl of Berlin. Perhaps the paper of most general interest was that read by T. F. Livingstone of New York, who attended the convention and was in charge of the exhibit made by the Jerome Kidder Manufacturing company of NewYork. Mr. Livingstone's subject was "The Difficulties of Utilizing Commercial Currents for Therapeutic Purposes from an Electrician's Standpoint." He said that the physician desires the use of the current for therapeutic work wholly and consequently must consider quite fully the financial investment. In the first place, to be quite safe from danger, it would be necessary to show the voltage of the line, also to indicate whether it was direct or alternating current. For electrolytic and galvanic work in general the direct current is necessary, owing to the fact that strong polar effects must be manifest. With alternating currents the direct polarity is lost; to modify the current of the street current would require some resistance device or rheostat to transform the current down in fixed proportions, these proportions to be further regulated by more direct devices. He asserted that an independent plant would give control of the current at all times and a thorough regulation within the limits of safety, and that the cost per ampere of street circuit would be in excess of the cost to maintain the primary plant of first-class goods.

The H. W. Johns Manufacturing company exhibited a device called "The Electrotherm," a flexible asbestos sheet or pad for use wherever the application of artificial heat is desired.

The Kennelly sinusoidal machine was exhibited by the Edison Manufacturing company of New York. This machine was designed by A. E. Kennelly, after considerable experimental work, upon request of Dr. W. J. Morton of New York, who had recently been in consultation with Dr. Apostoli of Paris, and had witnessed his use of the sinusoidal current, and wished a machine that would produce a sine wave of a strength suitable for electro-therapeutic work. The current from the machine is of a most pleasing character, and there is an entire absence of that pricking, painful sensation, which generally accompanies the secondary current from even the most improved high tension coils. The outfit is equipped with the most perfect methods of separately regulating, by very fine gradations, the number of alternations, strength of exciting current and amount of secondary current to be employed on the patient. This machine has already been illustrated and described in the WESTERN ELECTRICIAN.

The next annual meeting of the society will be held in New York City, where the newly elected president, Dr. A. P. Norton, and the secretary, Dr. F. M. Frazer, reside.

## Prize For Electric Heaters.

American inventors will be interested in the announcement that the German Hygienic association offers a prize of $1,200 for a research essay on the efficiency of electric heaters. "The heat given out in heating installations by heaters in their various forms and modes of use is to be ascertained. The investigations are to be described in detail in respect to the arrangement of the heaters, the nature of the heating agents and the observations made; and they are to be illustrated by drawings. The heating values obtained are to be stated in units of heat given off per hour per unit of surface. In the case of heat given out to air, the investigations must be conducted with currents of air at speeds as different as possible. The heaters are to be described in detail as regards form and measurement, and the relation of their heating efficiency to their weight is also to be ascertained." Essays must be written in German, and should be sent with a motto and sealed envelope to Professor Konrad Hartmann, Charlottenburg, Fasanstrasse 18, before July 1, 1896. The essay will remain the property of the successful competitor, but he is required to publish it within six months, and to give the organization gratuitously 300 copies. The association reserves the right to divide or withhold the prize.

## An Advantageous Arrangement.

[From the New York *Sun*.]

There are privileges for those students of Union College who take the electrical course. Not only have they the freedom of the works of the electric company at Schenectady, but they are to have the opportunity of entering the company's service when their course is completed. The ten best men in each year's examination will be taken into that service.

This is a provision which is likely to prove advantageous both to the students in electricity and to the electric company. The students will be prompted to do their best, and the company will have a constant supply of well-trained workmen. The students will have not only a theoretical knowledge of electricity, but also a practical acquaintance with the uses of it. The professors will not only lecture upon electricity in the class room, but will also steer the students in the electric works.

It is a new idea and a good one. If adopted by other colleges that have an electric course, there will be no lack of scientific and skilled workmen in electricity.

## Electrical-mechanical Clock.

Louis H. Spellier has devised some very ingenious movements for clocks, which every few minutes winds up the main spring that has been spent in propelling the clock works. The main feature about this spring is that even for very large clocks it is very short and the spring being wound up so often not only takes little power but remains almost at an even tension, thus affording far better regulation and less wear and tear on the clock gears. To show the simplicity of the device for winding this spring it is but necessary to follow it for one cycle. Say for instance the clock is running, and the power of the spring is partly spent. A point on the drum, which carries the spring, makes electric contact which energizes three magnets successively, winding the spring and carrying a weight past its highest point, which in dropping puts full tension on the spring and the clock is again ready for another few minutes' run, etc. Another great advantage of this self-winding clock of Mr. Spellier's is compactness. It occupies very little more space than an ordinary eight-day clock of any pattern or make, doing away with a lot of complicated gearing found in other forms of self-winding clocks.

## To the Montreal Convention.

The Lake Shore & Michigan Southern Railroad company will run a special train to the Montreal Street Railway convention, which will leave Chicago Sunday, October 13th, at 10:30 A. M. The train will arrive in Montreal at 2:30 P. M. Monday. The route from Buffalo will be via Utica and the Adirondack division of the New York Central railroad, and will afford a delightful ride through this charming region at a season of the year when it is most attractive. A special rate of $24 has been made for the round trip on the certificate plan, with a rate of $5 for a sleeper. Reservations may be made at the city office of the Lake Shore road, 180 Clark street. It is expected that the majority of the western delegates will go by way of the Lake Shore.

# CORRESPONDENCE.

## New York Notes.

NEW YORK, October 5.—When there is anything to be had in the way of public patronage or public franchises, reformers and Tammanyites, leaders of good government movements and machine bosses engage in a scramble that is highly amusing if it is not conducive to the promotion of confidence in public men. Only a few days ago there was a meeting in the city comptroller's office, the occasion being the disposal of a franchise for a street railway. It was truly amazing to see how eager some of our leading reformers were in their efforts to gain advantage over the machine bosses. No disguise was attempted. It was the first time in years that an opportunity had been given the "goo goo" element to get near the public crib, and most of their prominent men were there in person or represented by attorneys. Of course if a member of the committee of seventy secures a public franchise he will do wonders—in the way of talking; but the general impression is that he will sell out to Crimmins or some other real bad Tammany Hall man, possibly Croker.

At last an effort has been made, according to the daily papers of this city, to introduce religious animosities as a disturbing factor in the workings of the big street railway enterprises of the East. It is alleged that during the last three months agents of the American Protective association have been trying to prevent Roman Catholics from getting employment on the Atlantic Avenue railroad in Brooklyn. A similar attempt seems to have been made in regard to men seeking employment on the Heights road. Superintendent Cameron said: A short time since a doctor, who had some men employed on the road through his recommendation, came to see me and suggested that I join the A. P. A. because I would have such a good chance to keep Catholics from being employed on this road. I told him to get out of the office, and that any man he sent there would be fired out, as he would be if he tried to talk with me again."

The Rapid Transit commissioners are again "holding meetings." At the first one since the summer vacation Engineer Parsons made a report concerning the investigation and surveys made by him in regard to the underground railway. He and his assistants examined every building on Broadway from the Battery to Fifty-ninth street, and on Fourth avenue from Fourteenth street to Thirty-third street. He submitted 10 volumes of details and about 300 maps. Nine of the 10 volumes referred to are devoted to detail maps of every building and vault on the line of the west side route, from Bowling Green to Fifty-ninth street, and on the east side from Fourteenth street to Thirty-third street. In addition to these the maps show every pipe line, sewer, and gas main in the entire length of Broadway. The maps for the east side route are not yet complete, and when done will swell the number of detail maps to 500. Plans for the stations have also been prepared. The plans were approved.

A fight which has been going on for some time between the Electrical Workers' Union and the Theatrical Protective Union over the laying of electrical wires on the stages in theaters has been settled by the arbitration committee of the Board of Walking Delegates, which has directed that all the electric wiring behind the stage will be done by the Theatrical Protective Union and all before the stage by the Electric Wiremen's Union. This does not apply to the building of new theaters, in which case all the work of electric wiring is to be done by the Electric Wiremen's Union.

W. F. O.

## Milwaukee, Wis.

MILWAUKEE, October 5.—The city has not yet awarded the electric lighting contract. It is certain, however, that the Milwaukee Street Railway company will get the contract, but there is some uncertainty as to the terms which will govern the matter. One thing is settled, and that is that the company will have no competition. As stated in a previous letter, some of the aldermen made an effort to get from Captain Pabst, the wealthy brewer who operates a large lighting plant on Broadway for the purpose of furnishing light to his buildings down town, a bid to do the city lighting, but he has declined. Now the Common Council committee has submitted to the Milwaukee Street Railway company a proposition to award it the contract if the company will furnish light for five years at the rate per lamp per year that it asked for furnishing light for 10 years. This rate is $105 a lamp for lamps fed by an underground circuit and $87 a lamp for lamps fed by an overhead circuit.

William Tate, the electrician of the Davidson Theater, was killed by an electric car on Grand avenue last Saturday night, just before midnight. He was riding a bicycle on his way home from the theater and dismounted near Ninth street to look at his wheel. He mounted again, seeing a car coming, but did not get out of the way in time, and the car struck his rear wheel, throwing him with great force upon the asphalt pavement. When he was picked up he was dead, his neck having been broken by the fall. The car did not even touch him. His wife and three children survive him. Motorman Johnston was arrested, but was soon released. Tate carried no lantern and the street car men say that they did not see him until they were within a few feet of him. Tate came here from Chicago at the time that the Davidson theater was rebuilt.

Robert Stephan has got a verdict for $9,000 against the Milwaukee Street Railway company. The company's motion for a new trial has been denied. Stephan was thrown from the rear end of a Becker car in 1893 and his hand was cut off by one of the wheels. On a previous trial he got a verdict for $6,000, but at that time the court granted the company a new trial.

A trolley wire fell recently at the corner of Kinnickinnic avenue and Williams street and a few moments later a horse attached to a grocer's delivery wagon came along. The animal stepped upon the wire; there was a glare of light and the horse jumped into the air. He continued to jump about until enveloped by the wire and was finally killed. During the night a lot of placards were placed upon his carcass. One read: "I'm for McGann; I've had enough of Payne." Another requested that the "wires be buried" with him, and still another read as follows: "Hypnotized at 8 P. M. Saturday, September 21st."

Henry C. Payne, one of the receivers of the Milwaukee Street Railway company, has gone to Europe, and it is not known when he will return. He will probably take a course of treatment at Baden Baden, Germany, as his health has been very poor for some time. His resignation of the Northern Pacific receivership led to a report that he would retire as receiver of the street railway company, but he denied the story before he left for the East. The reorganization of the street railway is expected by about the time that he returns from his trip abroad. The company is really in very good condition. It is making money, its property is being kept up well. During the past summer seven miles of new line have been built at a cost of about $100,000. One extension was from the Soldiers' home to the State Fair grounds, a distance of about 1½ miles; another extension was the Clybourn street line, nearly two miles long, including rebuilt track, and besides there is the extension to Cudahy, three miles, almost completed. The Cudahy extension is single track, and the other extensions double track, so that the total of single track is about 10 miles. Next year the Clybourn street line will be extended to the Soldiers' home and Calvary cemetery. The extension to the State Fair grounds included a spur to North Greenfield.

In the exhibit at the exposition of the manual training school of the East Side high school there is displayed a miniature steam engine and dynamo designed and made by Rex Reinertsen, an 18-year-old boy who is attending the East Side high school. The engine is of one-half horse power and the dynamo that it drives supplies the current for three incandescent lamps. The engine is 18 inches high and occupies a space nine inches square. It is of the upright piston valve type, it has a 2½-inch stroke and its drive wheel makes 400 revolutions a minute. A countershaft has been put in to increase the speed of the dynamo, which makes 2,500 revolutions a minute. The engine cylinder is of polished brass, its working parts are of burnished steel and its base is of iron painted black. The cylinder is 1½ by two inches. The dynamo is after the style of the Edison machine. It is 10 inches high and occupies a space 10 inches square. The young builder has been quick to incorporate the best devices in his machine. The dynamo, for instance, has a sliding base to tighten the belt that runs it; the shaft has adjustable hangers that render it impossible for it to lose its horizontal position no matter whether the supports become awry or not. The young man has a boiler that goes with his machine, but it is not used, the steam to run the engine being obtained through small pipes connected with the boilers in the basement. The engine was built in the summer of 1894 and the dynamo last winter. Both were made in young Reinertsen's little workshop at home. He equipped his own shop, making most of the tools himself. His knowledge of engines and dynamos was acquired by watching workmen, by examining machinery and by reading. All the models used in the construction of the engine and the dynamo were made by him, and he made every part of the machinery except the base, which was cast at a foundry from a model furnished by him. Near the engine and dynamo described is a smaller engine—one-eighth horse power—which was made by him at an earlier date, it being the first engine made at the East Side high school.

C.

## Northwestern Notations.

MINNEAPOLIS, October 5.—The council committee on underground wires in this city voted to reduce the underground district some time ago, the companies pleading that they would be forced out of business if compelled to conform to the ordinance in all the district. Lately the committee has voted to again reduce the district, this time leaving the milling district and railroad yards outside. It has been eleven years since the ordinance was passed and still the wires are not all down.

A St. Paul syndicate has secured an option on the street car line at Waverly, Ia., and proposes to operate a first class electric line, and also to extend it to Cedar Falls.

A party of Western Union Telegraph company officials, including Col. R. C. Clowry, vice-president and general manager; F H. Tubbs, superintendent of the division with headquarters at Chicago, and others, were visitors in Minneapolis this week. They are making a tour of inspection.

The Sioux National Bank of Sioux City, Ia., has sued the Western Union Telegraph company for $2,000. About fourteen months ago the bank received a telegram signed Ed. T. Kearney, who was cashier of the Dakota County bank of Jackson, Neb., asking for $2,000. The money was sent and it was several days before the bank learned that the telegraph agent at Jackson had sent the message himself. As he was also the agent of the American Express company, the money went into his hands when it arrived and he appropriated it and decamped. The telegraph company claims the money was lost through the express agent, and a three-cornered fight is on now to determine who is responsible.

The S. E. Olson company of Minneapolis, during State Fair week had a trolley car fitted up with about 850 incandescent electric lights, there being a star on the front dashboard, and a large crescent on the rear. On both sides there were numerous lights and pleasing designs, and the colors were changing constantly. There were five colors used—red, white, blue, green and amber. Over 5,000 feet of insulated wire was used.

The Light, Heat & Power company of Northfield, Minn., is building a new power house and will increase its facilities.

The council of Albert Lea, Minn., has contracted with the Albert Lea Electric Light company for 30 arc street lights.

There is talk at Elk River, Minn., of putting in an electric light plant to light the saw and flour mills, and it is proposed that the village make arrangements to secure street lights from the same plant.

The Northwestern Electrical Manufacturing company of St. Charles, Ill., may locate a branch in Austin, Minn.

The Consolidated Street Railway company of Stt le, Wash., has let the contract to rebuild its power house.

The Chamberlain, S. D., electric light plant is now being operated by gasoline power, but it is not satisfactory and artesian wells will be sunk to furnish power. The famous well which has never been under control is near by. It has a flow of about 5,000 gallons per minute.

The University Heights Improvement company has been formed at Madison, Wis., to operate an electric light plant in that suburb.

The Marine Electric Propeller company of Minneapolis has been incorporated with $27,000 capital stock.

The D. & D. Electric Manufacturing company of Minneapolis has removed from North Minneapolis to Tenth avenue south and Fourth street, where it has improved facilities.

The West Side Placer company of Rawlins, Wyo., will put in an electric light plant in its Dry Gulch works and wash out gold day and night.

The plans and specifications furnished Fergus Falls, Minn., for its electric light plant were rejected and Oscar Claussen of St. Paul was employed to prepare new ones.

Seattle, Wash., is taking bids for street lighting for 1896.

A subscription list is being circulated at Olympia, Wash., to secure funds for electric lights for the business streets. The Olympia Light and Power company will furnish 10 arc lights of 2,000 candle power for $8.50 per month.

The contract has been let by the village of Worthington, Minn., for an electric light plant, to be completed November 10th.

The Sioux City Electrical Supply company of Sioux City, Ia., has applied to the council for the use of a half a block on Pearl street and if granted it will erect an electrical manufacturing plant.

The Capital Lighting company is a new electric light company of Helena, Mont., which has just begun operations. Its first rates were 25 per cent. below those of the old company, which at once met them. The new company cut again and the old company followed suit. Lights are now 50 per cent cheaper than they were a month ago, but the

end is not yet. The last cut of the Capital company offers incandescent lights for 50 cents per month for 10 o'clock service, and arc lights for $3 per month for the same service. Both companies are owned by local capitalists. M.

## PERSONAL.

Charles Blizard, New York manager for the Electric Storage Battery company, was in Chicago last week.

John C. Boss, president of the Lakon company and one of the most prominent citizens of Elkhart, Ind., and Miss Annie Rittle were married last week at the home of the bride's parents in Elkhart. The bride and groom are now enjoying a wedding trip, which will include a visit to Niagara Falls and New York city.

Announcement is made that William Hood will be connected with the Chicago office of the Electric Storage Battery company of Philadelphia. "Billy" Hood is one of the best-known men in the electrical fraternity of the West, and he is universally liked. He is a pione r in storage battery business in Chicago, and he has fought many hard battles, introducing accumulators when they were not as favorably regarded as they are to-day. The arrangement between Mr. Hood and the Electric Storage Battery company should be one of mutual advantage, and we congratulate both of them on the event.

C. B. Fairchild, editor of the *Street Railway Journal*, has decided to retire from the active duties of that position, but he will continue to study and discuss street railway matters. Mr. Fairchild is one of the pioneers of street railway journalism, but he has kept abreast of the times and to-day he is undoubtedly the best authority in this country among writers on street railway subjects. Mr. Fairchild's health failed about two years ago and, although he has regained much of his old-time vigor, he dislikes to continue in the exacting position which he held. The WESTERN ELECTRICIAN is pleased to announce that Mr. Fairchild's health is constantly improving, and this journal hopes that the colonel will be spared for many years.

## ELECTRIC LIGHTING.

An assumpsit suit for $200,000 has been begun by the Chicago Edison company against the Co-operative Electric Light company. Some time ago the defendant company, which did business on the North Side, went into liquidation and the Edison company bought the plant. The present suit is brought to settle up the deal and collect the claims due to the defendant company.

The United States Treasury Department is inviting proposals until October 16th for all the labor and material required to place complete in the United States Postoffice building at Lowell, Mass., a system of electric lighting. Additional particulars may be obtained from the Treasury Department, Washington, D. C., or by addressing Gardner W. Pearson, custodian of the Postoffice building, Lowell, Mass.

Matters have been amicably adjusted between the new Citizens' Electric Light company of Mishawaka, Ind., and the Dodge Electric Light company, whereby the latter's complete plant is to be turned over to the former company and installed at the water works as soon as the new building is finished and ready for it. The deal was completed at a meeting of the Citizens' company and M. W. Mix, representing the Dodge company. The consideration is $10,000 cash, and $3,500 to be taken out in lights to be furnished the Dodge company as required.

The plant of the ocean steamship "St. Louis" is described by a writer in the *Sun*. Of the electrical plant apparatus he says: Here are four large dynamos, with their gauges and wires and occasional flashes of blue light. On the wall is an elaborate switchboard and telltale devices to show when any one of the dynamos is out of order. The system in use is so arranged that each dynamo works separately or in conjunction with any of the others. Three of the dynamos are all that are necessary to do the work, and by the shifting of a little switch the lights can be turned on in any part of the ship from any one of the machines. The room is said to be the most complete in use, and it is practically impossible for the ship to be left in darkness by any accident to the lighting machinery.

## ELECTRIC RAILWAYS.

The Bergen County Traction company has passed into the control of the Elkins syndicate of Philadelphia. The syndicate proposes to build lines between Bergen county and Hudson and into Essex county. It is going to apply for a franchise for a road between Hackensack and Newark.

The East Side extension of the Citizens' Street Railway company of Kalamazoo, Mich., has been completed, and on September 13th the event was celebrated at the East Side park. For that occasion the company carried people without charge. Congratulatory speeches were made by city officials, prominent citizens and the treasurer of the company.

A rivalry between suburban electric lines on the south side of Chicago is on. Farson, Leach & Co. have asked for ordinances for six miles of extensions to the Calumet Electric system. The proposed extensions provide for a direct connection with the alley "L" terminal, independent of the leased Jacobs line, for two extensions eastward to near the lake shore on Seventy-third and Eighty-third streets, and for a southern branch from the end of these eastward spurs down to the state line at Roby. This southern spur cuts through the middle of the South Chicago city railway territory, and is being zealously opposed by that company.

Real estate men say there are more vacant stores on West Madison street, Chicago, than at any time within twenty years. The new electric lines and the cables are carrying shoppers to the South Side, to the detriment of West Side retail houses. The Metropolitan and Lake Street "L" roads, when the downtown loop is completed, will, it is claimed, be the last body blow to the business of Madison street unless something is done. The General Electric company is putting in new motors, which will be used within a few weeks, on the cars of the Lake Street company. Twenty-five of the smoking cars are being equipped with the motors. The Lake Street company is putting in the third rail system, the same as is now used on the Metropolitan "L" road. Some curiosity is manifested as to the attitude of the Siemens & Halske company toward the Lake Street company,

Reports of increased earnings by the North Chicago Electric railway come from a trustworthy source. The earnings for July, according to the Chicago *Chronicle*, were $16,000 net, and all summer the line has been earning net four to five times the interest on its guaranteed bonds. The bond issue now amounts to $400,000, a recent issue of $100,000 being about to come on the market through N. W. Harris & Co. This issue was made to meet the cost of winter equipment, it is said. The authorized capital is $2,000,000, owned by Mr. Yerkes and his friends personally. The road operates electric lines on Lincoln and Milwaukee avenues. It also operates the line of the Chicago North Shore railway under a 99 year lease, guaranteeing quarterly dividends at the rate of 6 per cent. per annum on the North Shore stock, amounting to $650,000. The North Shore power house, it seems, has been leased by the North Chicago Street Railway company, which pays in an amount sufficient to meet the interest on the $675,000 6 per cent. bonds of the North Shore company. The individuality of the North Shore company has therefore been pretty effectually swallowed up in the North Side corporate maze.

## TRADE NEWS.

The Onondago Dynamo company of Syracuse, N. Y., has recently placed new machinery and increased the manufacturing facilities to take care of the rapidly increasing trade. Recent orders have been so numerous that the full capacity of this concern has been taxed to take care of them.

A complete and very creditable catalogue of the Correspondence School of Technology has been issued. It is a "souvenir edition," and contains abstracts of letters from former pupils of the Cleveland institution, highly commending the course of instruction, and testifying to the practicability of the methods employed.

The Electric Engineering & Supply company of Syracuse, N. Y., reports that it has not been so crowded with work during the last two years as at the present time, and it is preparing to work over time in order to meet the increase of trade. The company has several novelties about completed which will be offered at an early day.

In the 1895 catalogue of the Emerson Electric Manufacturing company of St. Louis the following specialties are considered: Arc light transformers, push buttons, telephone cut-outs, connectors, spring clip cut-outs, distribution fuse boards, stage regulators, fuse blocks, knife switches and switchboards, alternating current motors and special work.

At no other period of the year has the Royal Electric company, Peoria, Ill., received more orders than at the present time. This company manufactures the well-known Royal alternator and transformer, which is in operation in so many plants in the West. The Royal company has found it necessary to run its force overtime in order to keep up with the demand for its apparatus.

The "Instruction Book" of the Hunt Air Brake company of Pittsburg is designed to give in as few and clear words as possible an analysis and complete description of the company's improved quick action brake, with a detail of each part and their relation to each other, so that the operator may become efficient and expert in its working. It is gotten up in very convenient form.

The Sunbeam Incandescent Lamp company of Chicago recently made a change in its officers, H. B. Vanzwoll having been elected secretary, the office formerly held by F. S. Terry, who has been made vice-president. Mr. Vanzwoll has been for a number of years connected with the wholesale hardware firm of Hubbard, Spencer, Bartlett & Co. and brings with him a valuable experience.

During the recent international yacht races for the America's cup between the American yacht Defender and the English challenger Valkyrie, the Western Union Telegraph company had a telegraph office anchored near the Sandy Hook lightship, which was in communication with shore through a submarine cable. The cable was of the Kerite make, and was 7½ miles long. The connection with the land lines was made at Sandy Hook.

The W. J. Davis Electrical company of Pittsfield, Mass., announces that it is now prepared to take up a line of experimental and scientific work in connection with all kinds of electrical instruments and apparatus, having the necessary tools and machinery to take care of this work. The company also announces that special attention will be given to inventors and electrical engineers who have model apparatus which they desire to have constructed.

Managers of central station plants, construction companies, in fact everybody interested in the installation of electric lighting, railway and power transmission plants, will find a valuable aid in the last publication of the Ball Engine company of Erie, Penn. Under the title "Improved Horizontal and Vertical Engines, Belted and Direct—connected to Generators," this company has presented a very attractive series of illustrations of its very latest types of equipment.

The Erie Canal Transportation company has decided upon the Medbery overhead equipment as being the most reliable for the severe service it requires. The order was placed last week and the agent of the Fiberite company, the Mason Electric Equipment company, feels elated over the deserved recognition of this high grade material. The Mason Electric Equipment company will represent the Medbery overhead material at the street railway convention in Montreal.

The fall season opens very brilliantly for the Boudreaux Dynamo Brush company. All its agents report very brisk business, and there is hardly any town in the United States which has not been supplied with some of the new foliated anti-friction metal brushes. Hugo Benedix, general manager of the company, feels very happy to see his efforts rewarded, and after one year's up-hill work to find that the Boudreaux dynamo brush has become a decided favorite with all the electricians.

## BUSINESS.

Julius Andrae & Sons company, Milwaukee, Wis., one of the oldest and best known electrical supply houses in the West, has done a largely increased business during the last month. This concern is able to fill all orders for supplies promptly on receipt, and this very important feature has gained for it a large and increasing number of customers.

The Fiberite company of Mechanicville, N. Y., is getting out some interesting circulars describing special features of the Medbery switches and other street railway devices. This company is enjoying a good business in Medbery material, and its western business, which is in charge of the Mason Electric Equipment company, is being constantly increased.

The Electric Appliance company, Chicago, is introducing a system of interior lighting, by means of the inverted Upton arc lamp, by which the light is thrown against a white ceiling, and thus diffused more evenly, it is claimed, than is possible in any other way. This arrangement entirely does away with sharp shadows and darkness in spots, and gives the nearest approach to sunlight that has yet been secured. It is particularly adapted to large stores, mills and factories, and promises to come into quite general use.

Friends of the reorganized Commercial Electrical Supply company of St. Louis will be interested to know of an extensive sale recently made by that company. President Joseph Franklin, Jr., has already secured the contract for all the overhead equipment for the new electric road from St. Louis to Meramec Highlands. This road is the most extensive electric road running out from St. Louis, being about 20 miles long. Such a deal as this, coming so quickly after reorganization, would seem to indicate that President Franklin knows what he is about and that the Commercial Electrical Supply company is on the road to success.

The new office case of the Ithaca Desk company is said to be, for general office work, the most convenient and lowest priced filing case made, and is specially adapted to lawyers, bank, real estate, insurance and railroad offices, manufacturers and retail merchants. It is made in quartered oak, polish finish, patent brass-lined roll curtain, fitted with a spring lock. The curtain is absolutely dust and vermin proof. A large drawer, shelves from seven to 15 inches long and 11 inches deep and pigeon holes 4¼ inches by 4¼ inches, 11 inches deep are provided. The case is 36 inches long, 48 inches high, 16 inches deep and weighs 130 pounds. The company's office is at 12 North Aurora street, Ithaca, N. Y.

It will be remembered that the WESTERN ELECTRICIAN recently announced the establishment in St. Louis of another incandescent lamp factory. The new company was incorporated under the name of the International Electric company. Recently a representative of the WESTERN ELECTRICIAN visited St. Louis and found that the company was progressing finely in its new undertaking. The work of factory equipment, under the charge of General Superintendent J. M. Davey, has been progressing finely, and the company expects shortly to be in a position to turn out in large quantities one of the best lamps in the market. Mr. Davey, who for many years has been identified with the manufacturing end of the incandescent lamp business, is giving his personal attention to the equipment of the company's extensive factory, and it is his purpose to turn out a lamp that shall be perfect in every respect. In a word, the International company proposes to spend considerable money in perfecting its machinery to an extent that will enable it to make a start in the business that will mean something and rapidly bring the "Davey" lamp into the foremost rank. The new lamp will be known as the "Davey high grade." The business management of the International Electric company will be in the hands of General Manager H. G. Ferguson, who is thoroughly familiar with the electrical business, having been identified with a number of large central stations in the West. Those who have met Mr. Ferguson believe that his energy and push, together with his courtesy and business-like method of treating those who have dealings with his company, will doubtless contribute largely in the success of the new company.

The Diamond Machine company of Providence, R. I., is making a specialty of surface grinding and polishing machinery. One of these, the automatic surface grinding machine described in the circular recently issued, is intended for grinding flat metal surfaces, hard or soft, where great accuracy is required, or where the parts to be ground are hardened, so that other methods of truing the face are difficult. The machine has a very heavy base, supporting both the table and the wheel directly from the floor, thus insuring great rigidity and stiffness. The bed which supports the table has suitable mechanism to automatically carry the work back and forth under the wheel, or the automatic features may be dispensed with at will, the table moved with the hand wheel or run to one end of the bed and stopped entirely, to change the work, without stopping the emery wheel or other parts of the machine. Adjustable stops are provided to limit the stroke to any desired length, or the lever in front of the machine may be used to stop and start the table instantly at any point desired by the operator. The machine will grind the surface of its own table, thus insuring the accuracy of all work done upon it. The emery wheel spindle, which is self oiling, is large in proportion to the diameter of the wheel, and is provided

with ample bearings in length and diameter. The outer bearings are of bronze and are carried by an overhanging arm with self-oiling box and drip to keep the oil from the work. The emery wheel is raised or lowered by a hand wheel and worm gear to give proper setting to the cut to be taken, and is capable of a very fine adjustment. Graduations on the hand wheel indicate the amount of this movement. The emery wheel has self-regulating cross feed in both directions, with adjustments to secure as much or as little feed as desired. The feed is arranged to shift at one end or at both ends of the table, thereby economizing greatly in time over a planer or milling machine, which cuts one way only. A guard is put on and around the table so that water way be used if desired. An automatic pump is furnished when ordered. Water and the pans connected with the same are inclosed inside of the column. Many other special types are built.

The Missouri Telephone Manufacturing company of St. Louis has just completed a magnificent piece of electric work for the Union Clothing company of the same city. The electric wiring in the entire building is all concealed work and provides for 1,000 incandescent lights, also 50 Helios lamps. The electrical effect in one of the windows is said to be the finest in the city of St. Louis, 300 lamps being surrounded by mirrors. In this connection it may be said that this is the only electrical concern in St. Louis making a display at the St. Louis exposition. It catches the music from Sousa's band and reproduces it by telephone. It is showing a number of novelties of its own manufacture, and also the different telephones. This is the first and only display of telephones made in the United States at an exposition west of the Mississippi river. The Missouri Telephone Manufacturing company claims, too, that the only successfull electric fountain ever placed in the city of St. Louis stands to its credit. It also placed in the same establishment a system of its "No. 2 improved interior telephones," which are something entirely new, gotten up by this company and covered by patents. With this telephone it is impossible to leave one's own phone connected with any other station after using. The transmitters used in this company's telephones as well as the switch are claimed to be non-infringing and covered by strong patents. The company, however, furnishes the Blake transmitter when ordered. While the Missouri Telephone company makes a specialty of manufacturing telephones, it is doing high class electrical construction work, and is prepared to bid on all classes of electrical work, from the installation of a telephone system to an electrical plant. Catalogues giving all particulars relative to its system of telephones are forwarded upon application. As an evidence of the merits of the Missouri telephone three or four of the electrical supply houses of St. Louis are handling it regularly. The company is also prepared to turn out of its factory anything of a special nature, and would be pleased to correspond with parties desiring figures. Messrs. Kusel and French, the active men in the company, are "hustlers" in every sense of the word and deserve to succeed.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued October 1, 1895.*

546,996. Armature for Electric Motors and Dynamo-electric Machines. Henry Chitty, London, Eng. Application filed July 26, 1892.

A dynamo electric machine of the multipolar type is provided with an armature wound with such a number of equi-distant sections that the sections may be divided up into groups, each composed of equi-distant sections, and each containing one more or one less than the number of magnetic poles.

547,031. Contact for Electrically Propelled Vehicles. Emil B. W. Reichel, Charlottenburg, Germany. Application filed April 4, 1894.

The contact device comprises a horizontal arm extending transversely to the trolley conductor, and adapted to make rubbing contact therewith, the arm being faced with a bar or strip of anti-friction metal.

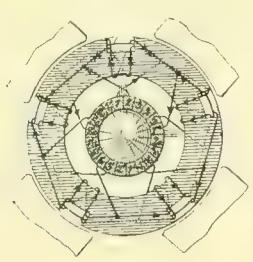
547,034. Electric Vibrator Mechanism. Frank J. Russell, New York, N. Y. Application filed April 15, 1895.

An electric bell is provided with an armature lever adapted to vibrate between the poles of two electro-magnets, two springs situated upon the opposite sides of the lever being connected therewith in a manner for facilitating the vibration of the lever.

547,035. Electrical Indicating Mechanism. Frank J. Russell, New York, N. Y. Application filed April 15, 1895.

An electro-magnet and an electric lamp are included in one branch of an electric circuit, in the other branch of which is provided a circuit closer controlled by the magnet, an indicating device being mechanically actuated by the circuit closer, a second electric lamp, and an electric bell being also included in the circuit.

547,043. Rectifier for Electrical Currents. William J. Still, Toronto, Can. Application filed December 24, 1894.



NO. 546,996.

The rectifier comprises a motor run from an independent source, and a dynamo, the fields of which are run from a shunt circuit through alternating current wires, a commutator of peculiar construction having its brushes connected through the main alternating current wires, and brushes for leading off the continuous current the armatures of the motor and of the dynamo and the commutator being all secured to a common shaft.

547,068. Electric Motor Truck. William G. Gaither and William R. Gaither, Chicago, Ill. Application filed November 10, 1894.

The motor truck frame comprises side-bars, having seats formed therein, cross bars having their ends arranged in the seats, adjustable supporting plates for the ends of the cross bars also arranged in the seats, springs interposed between the plates and cross bars, and devices for maintaining the plates in place.

547,069. Rotary Field Motor. Johannes H. F. Gorges, Berlin, Germany. Application filed October 10, 1893.

The motor is provided with two ring members placed face to face and carrying pluriphase windings adapted to produce a rotating magnetic field in the space between the ring members, the rotatable member being situated in the space between the ring members, and adapted to be rotated by the field, means being provided for rotating the ring members relatively to vary the strength of the rotating field.

547,071. Self-playing Mechanism for Pianos or Organs. Frederick W. Hedgeland, Chicago, Ill. Application filed February 23, 1894.

The keys are operated by means of a series of small bellows, one for each key, the bellows being controlled by electrical devices set in operation by the moving perforated paper strip customarily employed in this class of instruments.

547,072. Electric Device for Controlling Actions of Musical Instruments. Frederick W. Hedgeland, Chicago, Ill. Application filed February 23, 1894.

The invention lies in the combination with the moving perforated paper strip, of electrical devices for communicating impulses through the action of the instrument in accordance with the number, size and location of the perforations in the strip.

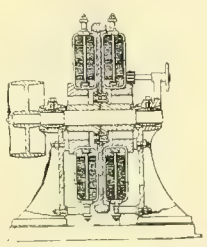
547,077. Electric Railway Repair Wagon. Anthony Iske and Albert Iske, Lancaster, Pa. Application filed December 18, 1894.

The wagon carries a platform mounted upon scissors-like bars, which may be moved to adjust the height of the platform.

547,078. Electrical Junction Box. Warren S. Johnson, Milwaukee, Wis. Application filed January 21, 1895.

A casing is provided with an elastic partition dividing the casing into two compartments, and constituting a base or support upon which a series of pairs of electrical contacts or terminals is mounted, a hermetic seal being provided between the several compartments.

547,106. Hanger Board for Electric Arc Lamps. Thomas E. Adams, Cleveland, O. Application filed July 17, 1895.



NO. 547,096.

The board has a stationary part, to which are secured contact springs adapted to be connected with the line while a movable part carries contact arms adapted to be electrically connected with the lamp, and adapted to engage the contact springs to include the lamp in circuit, a conducting bar being carried upon the movable part for engaging the contact springs to short circuit the lamp.

547,120. Insulating Compound. Salomon Heimann, New York, N. Y. Application filed February 28, 1895.

The compound is composed of pulverized asbestos, pulverized glass, rubber, rosin oil, mirbane oil, castor oil and dissolved celluloid.

547,121. Clutch and Motor Connection for Same. Hugh A. Kingsland, Belleville, and Whiting P. Sanger, East Orange, N. J. Application filed February 4, 1895.

The clutch comprises a rim attached to the motor shaft, a clutch plate carrying clutch levers which have heads adapted to engage the inside of the rim.

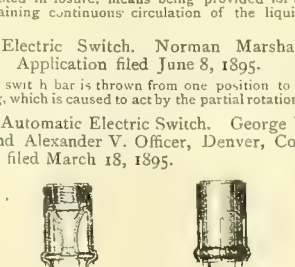
547,127. Electric Arc Lamp. Johan W. T. Olan, New York, N. Y. Application filed April 8, 1893.

The lamp is provided with liquid electrodes situated in an exhausted inclosure, means being provided for automatically maintaining continuous circulation of the liquid within the lamp.

547,149. Electric Switch. Norman Marshall, Boston, Mass. Application filed June 8, 1895.

The switch bar is thrown from one position to another by a spring, which is caused to act by the partial rotation of a spindle.

547,230. Automatic Electric Switch. George W. Russell, Jr., and Alexander V. Officer, Denver, Colo. Application filed March 18, 1895.



NO. 547,249.

A pair of auxiliary brushes is arranged at the outer extremity of each of two solenoids the reciprocating bar being so constructed that it is adapted to pass between the brushes and close the circuit of the opposite solenoid.

547,240. Electrical Safety Apparatus for Railways. Lewis W. Briggs, Chicago, Ill. Application filed August 24, 1893.

Each locomotive or engine is provided with two trolleys, one on each side and at different elevations, a circuit system being arranged along a section or block with which these trolleys act successively.

547,246. Mast Arm for Electric Lamp. John J. Drake, Providence, R. I. Application filed February 21, 1895.

The mast arm comprises a pole bracket, upon which is mounted an arm, carrying upon its outer end a head, the invention consisting in improved means for securing the several parts together, whereby the torsional strain on the arm will be resisted by the pole bracket.

547,249. Incandescent Lamp. Henry Green, Hartford, Conn. Application filed January 25, 1895.

Means are carried upon the bulb and upon the socket for maintaining the bulb and socket against longitudinal movement relatively to each other while permitting relative rotation of the parts.

547,265. Telephone. Harry T. Johnson, Elizabeth, N. J. Application filed June 18, 1894.

The invention comprises an arrangement of circuits, wherein the telephone and call bell are placed in parallel or multiple, one with the other, and each with its branch normally closed.

547,283. Trolley and Trolley Pole. Wilbur L. Pepper, Philadelphia, Pa. Application filed December 29, 1894.

The trolley pole comprises telescoping sections, rods pivoted to the sections, levers pivoted to the said rods, and means for tilting the levers to cause the upper sections to be extended.

547,300. Railroad Car Lamp. Charles G. Smith, Brooklyn, and Alonzo French, New York, N. Y. Application filed August 11, 1894.

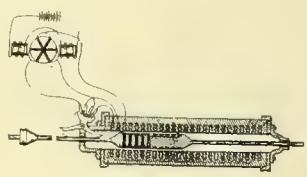
Means are provided for conveniently and delicately adjusting the height of the light bulbs relatively to each other, and also for adjusting the height of both relatively to the car.

547,302. Electric Motor for Street Cars. William Stine, Omaha, Neb. Application filed January 11, 1895.

The motor is connected by a worm and gear, with two driving shafts working in opposite directions, driving pulleys being loosely mounted upon the driving shafts in power connection with the car axles.

547,304. Conduit Supply System for Electric Railways. George Tolmie, Carbon, Wyo. Application filed July 10, 1894.

Automatic circuit-closing devices are mounted at intervals in a conduit, and consist essentially of two metallic contact points inclosed in a collapsible moisture-proof casing and sustained normally separated, one of the contact points being electrically connected with a supply lead; a current collector in its travel through the conduit successively closes the circuit through the contact points of the devices.



NO. 547,383.

547,323. Electric Motor. Addison E. Boggs, Allegheny, and Fremont J. Cleaver, Belzhoover, Pa. Application filed January 4, 1895.

The field magnet of the motor is secured to one side of a vehicle wheel, the armature being mounted upon the axle, while a commutator wheel is mounted upon a boss of the armature, and is provided with an insulated rim, upon which are placed commutator bars.

547,358. Electric Synchronizer for Clocks. Henry S. Prentiss, Elizabeth, N. J. Application filed August 10, 1892.

The several secondary clocks of a system are regulated to run fast, and provided each with a detent to cross the path of part of the train before the hour as indicated by the respective secondary clocks, and withdrawn at the exact hour as indicated by the master clock.

547,369. Device for Controlling Speed of Electric Cars. James Brady, Brooklyn, N. Y. Application filed June 24, 1895.

A speed governor is geared to the motor or its driven shaft or axle, and controls a movable contact which is included in the motor circuit, and is adapted to throw the motor out of circuit, or throw into circuit additional resistances for regulating the speed of the motor.

547,383. Reciprocating Electric Engine. Frank B. Rae, Detroit, Mich. Application filed May 31, 1892.

A magnet of indefinite length is provided with two or more sets of magnetizing conductors uniformly distributed along the tube and traversed by currents differing in phase, whereby corresponding sets of magnetic waves are produced in the magnet.

547,388. Telephone Exchange System. Ernest E. Yaxley and John H. Riley, Chicago, Ill. Application filed January 14, 1895.

The invention comprises a system of circuits for telephonic communication with the central exchange, a generator of the required power being provided in the central station adapted to ring the subscriber's signal through the armature winding of his call generator.

547,405. Telephone Toll Apparatus. George K. Thompson, Malden, Mass. Application filed May 13, 1895.

In the telephone circuit are included a battery, one winding of a repeating coil, and a receiving telephone; a signaling instrument is included in one of two normally open branches, while a circuit controller is included in the other, adapted to be operated by a mechanically impelled coin.

Western Electrician.

EVERY SATURDAY.

Vol. XVII. CHICAGO, OCTOBER 19, 1895. No. 16.

## Overhead Trolley for Chicago's Down-town Business District.

Work has been begun on the overhead construction for the South Clark street trolley system which the Chicago City Railway company is putting in. This is the first work of this kind that has been done in the down-town or retail business district of Chicago, and naturally it is exciting much interest and comment. Several months ago ordinances were passed by the city council granting the Chicago City Railway company a franchise for an overhead trolley system to replace the horse cars now in use on South Clark street. Of course there was much opposition to the measure, although it was apparent that the objections were of a general nature and came from persons not directly interested in South Clark street property. As a matter of fact property owners and business men on that thoroughfare were almost unanimously in favor of the substitution of the electric motor for the present unsatisfactory service. The mayor vetoed the first ordinance; then a compromise was reached, the company accepting an ordinance granting the right to construct a trolley system on South Clark street as far north as Adams street. The mayor approved this ordinance, but the business men of that portion of the street north of Adams street were not at all pleased and they have since secured the consent of nearly every Clark street property owner between Adams and Washington streets, and an ordinance is now pending in the council providing for an extension of the trolley line to the City and County buildings. This will extend the line through the heart of the business district of Chicago. For the present, however, the line stops at Adams street, directly in front of the office of the WESTERN ELECTRICIAN. Two views of this end of the line are presented in the accompanying cuts, showing the appearance of the street just after the construction work was begun. Fig. 1 is a reproduction of a photograph showing the apppearance of the pole line looking south on Clark street down the center of this busy street. Fig. 2 shows a familiar scene at the corner of Adams and Clark streets, the north end of the trolley line at the present time. It will be observed that this is a very busy district, and that it is necessary to facilitate travel in these thoroughfares as much as possible.

FIG. 1. OVERHEAD TROLLEY FOR CHICAGO'S DOWN-TOWN BUSINESS DISTRICT.—VIEW OF CLARK STREET CENTER-POLE LINE LOOKING SOUTH FROM ADAMS STREET.

As was expected the beginning of this work aroused a perfect storm among the opponents of overhead trolley lines and the daily papers kicked vigorously against the project, but to no purpose. The construction of this line puts an end to the prohibition against overhead wires in the down-town district of Chicago, and should the property owners gain their point and secure an extension of the line to Washington street it would bring the trolley almost to door of the mayor's office. Out of consideration for the prejudice against the overhead wires in the street the Chicago City Railway company accepted the center pole construction, as this style does away with the network of wires that are often necessary when side pole construction is employed. A representative of the South Side company told a reporter that just as soon as the poles are all up, wires will be strung and the line connected with the trolley lines south of Twenty-second street.

"We hope to have rapid transit from Englewood in operation in less than ten days," he said, "and I feel certain that when the property owners in Clark street have experienced the benefits, they will conclude that the trolley is not such a bad thing after all. We do not regard the center pole as more dangerous than the side pole construction, but we would have preferred the latter if the council would have permitted it. It will not injure street traffic. The poles will simply tend to make drivers stick to their own side of the street. There will be less crossing and recrossing, and I have no doubt that the public will be the gainer."

The effect of the poles was very odd, and they completely change the aspect of the street. The first one was set up at the corner of Adams street and is shown in Fig. 2. With its slender cross arm near the top it presented an odd appearance in the middle of one of the busiest thoroughfares in Chicago, and hundreds of men and women assembled on the sidewalks to look at it. After the pole had been straightened to the satisfaction of the bosses of the job it was packed down with concrete and the paving blocks were laid around it again. When the others were in place the effect was emphasized,

and the oldest frequenter of the thoroughfare hardly recognized that Clark street that has become historical for its many phases.

As has already been mentioned, this will be the first trolley line that has been extended into the south side business district of the city, and for that reason if for no other it will be unique. What its effect is going to be upon Clark street, which is one of the main arteries of the city, is in a measure problematical. The ordinary traffic of the street is enormous, and on account of being very narrow it is always congested during business hours. The center poles that the company has adopted, it has been claimed, will not improve conditions. They are so near to the tracks that careless passengers who protrude their heads or arms from open car windows will be in danger of getting hurt. The south side company's other electric lines are constructed with side poles, notwithstanding that they cost much more than the center-pole construction. If the company could have built the South Clark street line in the same manner it would have done so, but the council in passing the ordinance insisted that the center poles would have to be used. The statement is made that the railway company was not averse to the introduction of the center-pole construction on South Clark street, as it would give the Indiana avenue property owners an idea of the appearance of the style of construction which the company hopes to introduce on that south side residence street. In order to make a favorable impression

FIG. 2. OVERHEAD TROLLEY FOR CHICAGO'S DOWN-TOWN BUSINESS DISTRICT.—FAMILIAR SCENE AT THE PRESENT NORTHERN TERMINUS OF THE SOUTH CLARK STREET TROLLEY LINE.

the very best construction work possible will be used. Much depends upon the successful operation of the Clark street line. A committee of property owners is at work securing consents for the extension of the wires from South Water street to Washington street. The North Chicago Street Railroad company wishes to run its north side cars to Washington street without changing to horse power, and a majority of the property owners are said to favor the plan. The ordinance for this extension is to follow closely on the ordinance extending the City railway's Clark street trolley wires from Adams to Washington streets. The two companies are working in harmony, according to the daily papers, and the indications are that both ordinances will be passed over the mayor's veto, if he interposes it. General Counsel Grinnell of the City Railway company, who drew up the Clark street extension ordinance, makes the claim that the public should not object to the poles and wires in the business district, as the ordinance is only for eight years. "Before the franchise expires," said ex-Judge Grinnell, "it will be demonstrated whether there is a preferable system of underground propulsion that will stand the test of actual use. It is not an unreasonable request that the short-term franchise should be granted, leaving the city free to adopt some other plan within eight years if some better method is developed within that time. The cost of building an underground system should not be an obstacle in a limited area of the business district, but it would bankrupt any corporation to attempt to introduce the present underground systems on its outlying lines. The element of cost and the uncertainties attached to present underground systems, which are only in the infancy of development, are what make the trolley system safer and more practicable just now."

There is no doubt in the minds of Chicago street railway men that as soon as the trolley system is in operation on South Clark street, opposition will cease. Electric cars are operated in Boston's narrow, crooked streets, and it is argued that just as good results can be obtained in Chicago.

## How Shall We Heat Our Cars?[1]

By J. F. McElroy.

The question "How Shall We Heat Our Cars?" which has been assigned to me as the subject of this paper, appears to recognize the fact that the time has arrived that cars, in which passengers are to be carried during the cold months of our northern winters, must be heated. The popular demand for warm and more comfortable cars sprang up with the advent of electric traction and the improvements in construction and service of street cars which electric traction made possible. I propose to direct your attention to-day to some of the general principles involved in the construction and operation of electric heaters, and then to present some matters bearing upon the subject of the amount of heat produced and the cost of same.

The general principle employed in the construction of electric heaters is that of placing in these heaters suitable resistances which become heated by the passage of the electric current. The principle of heat generation by the passage of the electric current through a resistance was well understood in the early part of this century, but special attention has been drawn to it since apparatus employing resistance has come into such general use. In fact, there is no known conductor but what becomes heated through the passage of the electric current, so that it is impossible to build any kind of device for transforming electric energy, but that such apparatus contains resistance and is heated by the passage of electric current in proportion to the resistance and in proportion to the current passing. It is true that this heating effect in conductors may be reduced to a minimum by using the best known material for conducting electric current and making this material into wires of large cross-section and in this way decrease the percentage of the current which is converted into heat.

I believe that the Burton heater was one of the earliest electric heaters tested on the electric railways in this country. In this heater a resisting wire of German silver was bent in a zigzag form and placed within the hollow space between two iron castings. The wire was embedded in powdered fire clay, and the castings bolted together so as to prevent the loss of fire clay and the disarrangement of the resisting conductor. These two castings, which together formed the casing or outside of the heater, contained a roughened surface for the purpose of enlarging the radiating surface of the heater itself. It was claimed that the embedding of the resisting conductor within a powdered mass of fire clay prevented the air from reaching the conductor and hence prevented its destruction by oxidation when exposed at high temperatures to air.

I think there is no doubt that oxidation in a resisting conductor may be retarded, if it is possible to keep the oxygen of the air from reaching the surface of the conductor, but it must be apparent that by such a construction results may be reached which are just as objectionable as the oxidizing of a conductor by contact with air. It is evident that the embedding of a resisting conductor in powdered fire clay or other material which, from its very nature, would be classed as a non-conductor, would retard the escape of heat. The objectionable result is then reached that the temperature of the conductor rises to such a degree that its life is soon destroyed.

In considering the conditions which exist in electric heaters and which led to the early destruction of the resisting conductors we are brought to see that after all the question of building an indestructible heater is comparatively a simple one. In the first place, high temperature is one of the conditions which lead to the destruction of the resisting conductor. This difficulty arises from the fact that oxygen of the air will attack metals more strongly when a high temperature is maintained in the metals. Another cause of the destruction of resisting conductors lies in their crystallization at high temperatures. This is a difficulty to which German silver or any alloy of different metals is especially liable. For example, German silver is composed of copper, nickel and zinc in equal parts, the zinc having a melting point of 680 degrees Fahrenheit. Now if this metal is used in electric heaters and its temperature is run above the melting point of zinc, it will be found that crystallization of the zinc in the conductor takes place, and in a short time the wire separates and the heater becomes useless. Crystillization of zinc often occurs from jarring or vibrating a wire at a much lower temperature.

Now, it is not necessary in the construction of electric heaters to run near to either danger point which I have just mentioned, that of high temperature, or the danger from the use of German silver or other alloys. It is apparent that the temperature above air of the resisting conductor depends upon the amount of heat which that conductor gives out per square foot of its surface, and that the total amount of heat would, therefore, depend upon the number of such units of surface which there may be in the conductor. By multiplying the actual surface by two, we divide the temperature of this conductor above atmospheric air by two, and still give out the same amount of heat. This reduction of temperature in the resisting conductor may be carried to any extent desired by simply increasing the amount of actual surface in the resisting conductor to such an extent that the temperature of this conductor will be reduced to a point where the conductor is absolutely safe and its life is permanent. For example, if I find that by using a certain size and length of wire in a car I can obtain sufficient heat in the car by maintaining the wire at 1,200 degrees Fahrenheit above the temperature of the car, I may obtain the same amount of heat by using four times the amount of wire and then running the temperature of this wire at 300 degrees above the temperature of the car. By adopting the second construction I may entirely obviate the trouble which arises from running the heating conductor at the high temperature of 1,200 degrees above the air. In fact, by enlarging and increasing the amount of actual surface of the conductor itself, we reduce the temperature of the conductor to such a point that no apparent oxidizing effect takes place. I show you to-day samples of electric heaters in which there is such an enlargement of heating surface, and this surface is so exposed to the air that the heat may be carried from this surface as fast as generated. These heaters are made by the Consolidated Car-heating company, and are shown in different forms adapted to the different kinds of construction of cars to which electric heaters are applied. In the construction of these heaters cylindrical porcelain tubes are threaded upon a five-eighth inch square iron rod. These tubes are provided on their surface with a spiral groove which runs continuously from end to end. A porcelain disk is placed at each end of the heater, and when desired one is placed at the center for the purpose of furnishing supports for the binding screws to which the ends of the resisting conductors are attached. We then coil a No. 20 B. & S. galvanized wire in the form of a close and continuous coil. As this wire is wound by a machine in the form of a continuous coil, just so much of the wire is separated in forming a coil as gives us just the proper resistance. These coils are then placed in the groove which runs spirally around the porcelain insulators. Care is taken to stretch out the coil sufficiently to prevent adjacent spirals of the coil from coming in contact with each other, and contact with that part of the coil in neighboring grooves is prevented by ridges separating the grooves on the porcelain. The result is that this wire is thoroughly insulated and short-circuiting within the heater itself is prevented, and still it is wound open so as to present its whole surface to the air. It is so arranged, too, by its even pressure upon the porcelain insulator that no part of this coil can vibrate, and hence there is no danger from the crystallization of the iron while hot from tremor or vibration of the heated wire. These coils have now been operated for over three years and not one coil has given out or has shown any oxidizing effect in the substance of the wire. The use of iron as a resisting conductor frees us from the difficulties of crystallization to which German silver is especially liable. The melting point of iron is at a temperature of nearly 3,000 degrees Fahrenheit, so that the temperature of fusion is so far above the normal temperature of the resisting conductor, and as vibration of the conductor is prevented by the method of winding it on the insulator, no danger occurs from oxidation, fusion or crystallization.

It is important in the construction of electric heating devices that the expansion of the metallic wire due to change of temperature be fully provided for, and that the heater be so arranged that under no circumstances can the force of expansion and contraction create a strain upon the resisting conductor or upon the insulating parts which would be liable to injure or to break them. Another fact is also to be noted; that the length of a wire which is subjected to heat at intervals and is allowed to cool will gradually shorten and the contracting force may, in certain constructions of heaters, cause the breakage of the wire itself. What I mean is, it is a well-known principle that a wire of a given length, if heated and then cooled, and again heated and cooled, is not the same length at the same temperature that it was in the first test. Changes will go on for some time in lengths of wires so subjected to heating and to cooling, and this fact

1. Read before the Street Railway Association of the State of New York, Albany, September 17, 1895

should be considered in the construction of electric heaters.

On the other hand, care must be taken that under no conditions can the expansion of the wires make it loose on the insulator and so cause a short circuit between neighboring wires. The amount of expansion taking place in the amount of wires used in a car equipment of the heaters which I have shown you, is seven feet five inches; that is to say, the length of wire when heated to the highest temperature to which it is subjected in the regular operation of the heater is seven feet five inches longer than it is when cold. By the construction adopted in this heater it is apparent that this expansion is taken up between consecutive layers of the wire itself.

The changes of temperature in resisting conductors are attended with other phenomena which should be considered in the construction of electric heaters. For example, it is well known that the resistance of a wire of a given material of a given length and cross section depends upon the temperature at which the resistance is measured. Iron wire possesses certain qualities in its variation of resistance with temperature which I think admirably fits it for use in electric heaters. I show a diagram, Fig. 1, in which the upper curve shows the change of resistance in a coil of iron wire, having a resistance of 100 ohms, due to the different temperatures of iron, as indicated on the horizontal line. From this it will be seen that an iron wire having a resistance of zero centigrade of 100 ohms has its resistance doubled when the temperature is increased to 180 degrees centigrade, and that its resistance becomes 300 ohms when its temperature is 315 degrees centigrade. This same resistance is increased to 500 ohms when its temperature is 525 degrees centigrade. In other words, a rise in temperature of the resisting conductor is always attended with an increase of resistance, and conversely, a lowering of temperature is always attended by an increase of conductive power.

The expansion of German silver is shown in the lower curve of the same diagram. It will be here seen that change of resistance in German silver is but a mere fraction of the change of resistance of iron wire. For example, in wire of German silver, which at zero degrees centigrade or at 32 Fahrenheit, has a resistance of 100 ohms, its resistance

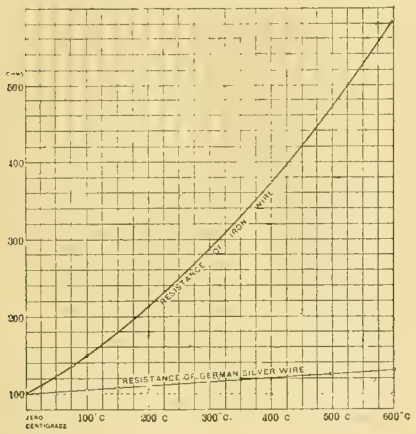



FIG. 1. HOW SHALL WE HEAT OUR CARS?

at 300 degrees centigrade is increased to 114 ohms instead of 287 ohms in iron wire.

The use of the variable resistance so marked in our iron wire is apparent, as its effect is to reduce the amount of current flowing through the heater and hence to reduce the amount of heat generated. By referring to our diagram we will see that the two electric heaters, one of iron wire and the other of German silver, both having the same resistance at zero centigrade and both being covered with a non-conducting hood which prevents the escape of heat, would, as the temperature rises, act very differently. For example, if the temperature rises to 100 degrees centigrade there would be approximately two-thirds as much current passing through the electric heater with the iron wire as through the electric heater with the German silver. If the thermometer rises to 200 degrees centigrade, the amount of current now passing through the heater with the iron conductor is about one-half of what is passing through the German silver, and hence only about one-half as much heat is generated. If the temperature rises to 300 degrees centigrade, only two-fifths as much current would pass through the iron resisting wire as passes through the German silver. This throttling action of the iron wire increases more rapidly even than the increase of temperature, so that at 600 degrees about one-fifth as much current passes through the iron wire as passes through the German silver. This means that the current through the iron wire is reduced in proportion to the fractions which I have just given, and the reduction in current means also a reduction in the amount of heat generated. A heater, therefore, provided with an iron resisting conductor has this peculiarity over that equipped with German silver, that if for any reason the escape of heat from an electric heater is prevented either purposely or accidentally the action of the rise of temperature upon the heater itself is to so throttle down the amount of current passing through it and hence the amount of heat generated as to prevent such a high temperature of heat that might prove dangerous. We will see the application of this with electric heaters, if, for example, we consider the case of two heaters, which we have been comparing, in a car filled with passengers, in which there is a partial covering of the discharge openings of the heater by the clothing of the passengers. The action of an accident of this kind on the heater provided with an iron conductor is to stop in a measure the flow of current through that heater, so that by the time the temperature of the wire rises to 400 degrees centigrade, three-fourths of the current has been shut off, and hence only one-fourth of the normal amount of heat is generated. This, as a matter of fact, could never occur, even were the discharge openings of heaters entirely closed, as the throttling action of the heater itself reduces the current to such a point that comparatively a small rise in temperature would take place, due to the fact that part of the heat would find means of escape. This throttling action of the electric heaters with iron resisting conductors is best illustrated in Fig. 2. This diagram shows the principle which we have just been discussing, applied to electric heaters. The upper curve is a curve of temperature obtained from a thermometer placed within the porcelain insulator itself. The two lower curves are

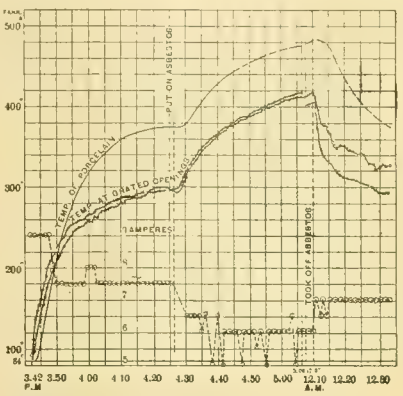



FIG. 2. HOW SHALL WE HEAT OUR CARS?

curves of temperature, obtained by two thermometers placed within the heater casings and about one-half an inch above the coils of the heater proper. An idea of the rise of the temperature of the air in the upper part of the heater casing may be obtained from these curves. The time is laid out on the horizontal lines, the vertical lines being lines of temperature. After the heater has been in operation until the temperature within the porcelain and the temperature within the heater casing, as indicated by the two lower lines, had become practically constant, we then covered up the discharge opening of the heater with a close fitting sheet of asbestos which would prevent the escape of heated air. The effect upon the temperature within the heater casing is at once apparent, and the upward movement of the curve indicates the rate and amount of that rise in temperature. As I have already pointed out, this rise of temperature must mean a lowering in the amount of heat generated. The throttling action of this can be seen in the fourth curve to which I call your attention. This fourth curve represents the amount of current passing through the heaters and also represents the amount of heat generated. In the first place, when the current is first closed through the heater you will see that a large flow of current takes place until the heater itself becomes heated up, when the amount of current is automatically throttled down. This of itself is of advantage in more quickly bringing the heater to its maximum temperature. This curve remains nearly horizontal, indicating a nearly steady flow of electricity until it reaches the point where the discharge opening of the heater was closed. You will see at once that the current drops and the amount of this drop indicates the amount of the throttling action of the resisting conductor itself. This also means, and this point I desire to emphasize, that anything which interferes with the discharge of the heat into a car also acts to cut off the amount of heat generated in that heater and hence to prevent in a measure the rise of temperature which would otherwise take place within the heater itself. At the point indicated in these curves, the asbestos damper was removed from the discharge of the heater and the curves then indicate the fall in the temperature of the space above the heater, while the curve showing the amperes rises in a very short time to its normal height, indicating that when the heat is

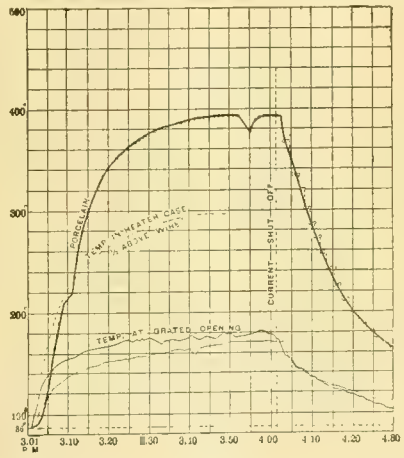



FIG. 3. HOW SHALL WE HEAT OUR CARS?

free to discharge from the heater more heat is generated. This action will take place in any heater in a car, and will take place in one heater independent of other heaters. This curve, however, may give a wrong impression as to the temperature at the discharge of the opening of the heater itself.

The diagram, Fig. 3, has been made from tests in which the temperature at the grated openings has been taken very carefully with thermometers placed against the grated openings, but not within the heater case. This would indicate the temperature in front of the heater openings and at points were the clothing of the passengers might possibly touch. I introduce this simply to show that the highest temperature in the air that is reached is about 180 degrees Fahrenheit. This being the temperature of heated air, it is evident that its effects upon either the clothing or limbs of passengers could not be in any way dangerous or disagreeable. This is due to the free discharge of air up through the heater by which the heat, as fast as it is generated, is carried into the car. A curve is also shown, which is not the curve of temperature of the air discharged from the heater, but is the temperature recorded by thermometers placed within the heater case and within one-half inch above the wire coils. The upper curve indicates the curve of temperature of the porcelain itself, and is obtained from the readings of the thermometer placed within the hollow openings of the porcelain. I desire to call your attention to the forms of these curves, both when the temperature rises when heat is first applied, and to the temperature of the curve obtained when heat is shut off. It is seen that the temperature of the porcelain rises rapidly and the temperature also descends rapidly when the circuit is open.

I now desire to call your attention to the conversion of electrical energy into heat. The last 50 years have witnessed changes in popular notions on many points. Two great scientific theories, unknown in the early part of this century, have in recent years been accepted as part of our scientific faith. They have assumed control of the scientific mind in all questions involving phrenomena of matter and force. I refer to the consevation of matter and the conservation or persistence of force. According to the first theory, we believe that all matter now existing has always existed in its elements and that these elements are indestructible. According to this theory, we believe that the carbon which unites with the oxygen of the air in the process of combustion of the carbon is not destroyed, but exists with the oxygen in the form of carbonic acid gas, and that when this gas enters into the growth of plants the carbon is separated from the oxygen and may be restored to us again as free carbon. The next theory is that of the conservation of force, according to which we believe that energy is wholly converted in every translating device. In other words, energy is indestructible. It cannot be annihilated. It is true that in most of the applications of force in the operation of machinery that the efficiency of the apparatus is less than 100 per cent.; that is to say, less energy in one form is delivered by a machine than what is delivered to it. This is because translating devices usually convert energy into

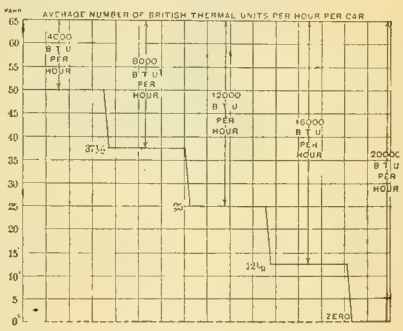



FIG. 4. HOW SHALL WE HEAT OUR CARS?

several forms and therefore any one form of energy contains less than the whole. Electricity being a form of energy, we may say that electrical apparatus generally transforms into the desired form of energy less than 100 per cent. Now, if the theory of the conservation of force is true, all of the energy can be accounted for in some way. Let us examine for a moment the forms of energy into which electrical energy may be converted. We have, first, mechanical motion; second, chemical action; third, light; fourth, magnetism, and fifth, heat. This list, I believe, comprises all possible forms of force into which electrical energy may be transformed. Of course, it is apparent that the so-called efficiency of any transformation of electric energy depends upon the useful work which we are endeavoring to produce with the electric current. If it is the electric motor 90 per cent. is realized; if the incandescent lamp, 5 per cent., although if we were using the incandescent lamp as an electric heater, we would call its efficiency 95 per cent., instead of 5 per cent. We then come to the transformation in an electric heater. Again, we will employ 100 units of electric energy. We find that there is no mechanical motion, there is no chemical action, no light, no magnetism. Heat, therefore, must be the only form of energy into which the 100 units of electric energy have been transformed. The electric heater, then, is the only case that comes within our knowledge where 100 units of electric energy may be transformed into 100 units of any other one form of force. We can then establish the heat equivalent to the electric current for all electric heaters in which no disintegration takes place in the resisting conductors as one British thermal unit (one pound degree Fahrenheit) is produced by 1,047 watts of electric energy. I speak of this quite at length for the reason that we are constantly meeting with business men as well as so-called inventors of electric heaters, who claim that some particular form of electric heater which they have devised will produce a greater amount of heat per unit of electric energy than some other form of heater. This is plainly impossible, so long as neither mechanical motion, chemical action, light nor magnetism are produced in the electric heater. Transformation of electric energy into heat is, therefore, accomplished with an efficiency of 100 per cent. It is true that in some of the forms of electric heaters a chemical action, resulting in the destruction of the heater, is produced by the electric current. Where chemical action takes place, the chemical action can be determined in units of energy; the efficiency then of that particular heater must be 100 per cent. minus the amount so transformed into chemical action. But where we have the wires of electric heaters running year after year without any change of any kind appearing in these wires, it

is evident that the efficiency may be regarded as 100 per cent.

Practical experience in the heating of cars has demonstrated that it requires about 20,000 British thermal units per hour to properly heat an 18-foot car in the latitude of New York state in the coldest weather, which amount of heat should be provided as a maximum. The average requirement during the months of the winter when heat is used would not exceed one-half of this amount or would be, approximately, 10,000 British thermal units per hour (Fig. 4).

The amount of heat required to heat a car differs somewhat according to the construction of cars, to their exposure to winds on the lines where they are run and to the care exercised by conductors in closing the doors promptly when passengers enter or leave the cars. All of these are points which affect materially the temperature which will be maintained in a car with a fixed amount of heat. Also the number of people in a car affects quite perceptibly the amount of heat required. Crowded cars require less heat to maintain a given temperature than is the case with cars carrying but few passengers, due to the amount of heat given off from the bodies of passengers. Experiments have been made as to the effect of passengers upon the temperatures of cars and houses. It has been found that each person gives out 191 British thermal units of heat per hour. When we compare this amount with the average amount of heat required during cold weather, we find that the heat given out by 52 persons will maintain the same temperature in a car as is required on the average during the winter months. This point has a practical bearing in the heating of cars, in that, if a car is heated uniformly as with a stove, it would be found overheated during those hours of the day when the cars are filled with passengers. When electric heaters are used some roads have established the practice of reducing the heat between certain hours when their cars are filled with passengers. This would still allow a comfortable degree of heat to be maintained in cars, at the same time would allow the use of the extra power for propelling cars at the time when travel is the heaviest. The next point in regard to electric heating is the regulation of temperature. As the temperature of the outside air during the heating season will vary from 50 degrees to 15 below zero, I consider it important that the electric heating apparatus be so constructed that the amount of heat given to the car can be varied so as to meet the demands of the variable weather. This is necessary for two reasons: First, it is necessary in order to maintain a comfortable temperature in the cars with variable conditions in the weather, and second, it is important in order that the consumption of current shall be adjusted to the actual demands. Undoubtedly a great saving in the use of current is brought about by the use of apparatus that is provided with means for proper regulation. I show you a device which we have extensively introduced for the purpose of regulating the temperature of the cars, by which five different intensities of heat may be obtained corresponding to consumptions of current varying from 2¼ to 12 amperes. This switch is what is known as the five-point switch and is a device for shifting and heating coils constituting the car equipment, into series and multiple series relation to each other so as to vary their combined resistance, and hence to vary the flow of current through them. On small cars and in climates where comparatively a small amount of heat is required, we also use an equipment consisting of four heaters instead of six, as in the standard equipment. These four heaters are connected up with what we call the Three Point Switch, which is so arranged as to place the heating coils in multiple series so as to vary the consumption of current from 2¾ up to eight amperes.

As to the cost of heating cars by electricity, it is evident that the cost is determined by the cost and quantity of current consumed. If the number of ampere hours on a 500 volt circuit can be once determined and the cost of an ampere hour on the same circuit is known, the cost of running electric heaters can be easily ascertained. The question of cost, however, is not easily determined, as it still remains an open question as to just what items should be charged to electric heating. I am inclined to think that it would be but fair for a company considering the advisability of introducing electric heaters in their cars, to consider, not the total proportionate cost of current consumed, but rather the additional cost of generating the current to supply the electric heaters. In other words, it would not seem just to charge to electric heaters such power house expenses as would continue the same, provided the electric heaters were not introduced; but instead, to charge only the cost of the additional current. These costs have been carefully determined, based upon the cost of producing power by different types of engines as contained in the paper of Charles E. Emery, Ph. D., which is printed in the proceedings of the American Institute of Electrical Engineers for March, 1893. These figures have been carefully revised to agree with results obtained in the most modern types of engines. The costs are based upon units of 500 horse power, andso far as the figures by Mr. Emery are concerned, give the cost of horse power in the engine wheel or jack shaft. I have then, allowed the efficiency of 90 per cent. in the generators and assume an efficiency in the distributing system of 93 per cent., making a combined efficiency of generators and lines of about 82 per cent.

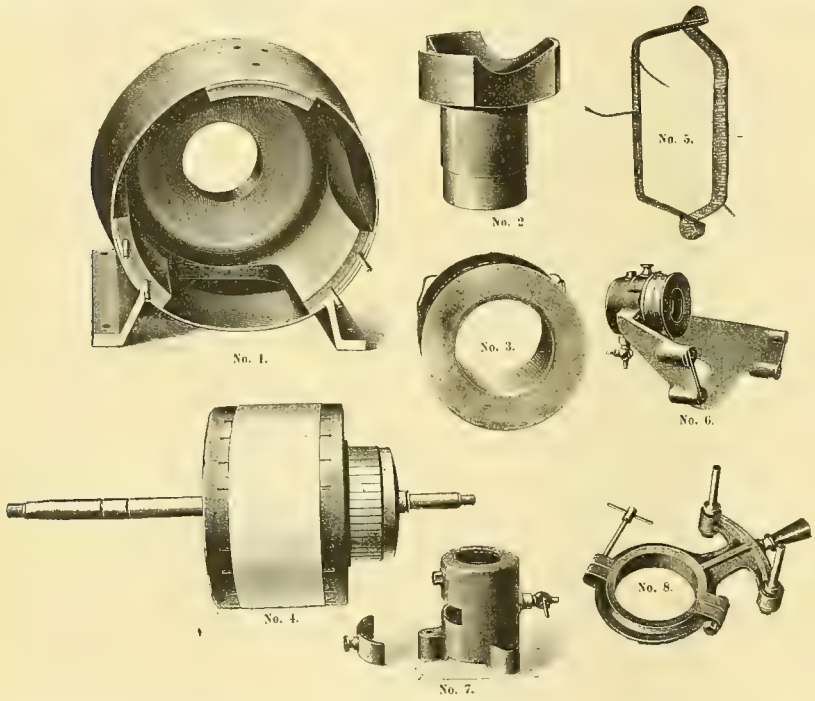
From the reports which we have recently received from the street railway companies in this state I find the average efficiency of the lines of the companies reporting was .923. This so closely confirms my previous estimate of .93 that the figures based on my former estimate are still retained. Corrections can be made upon the figures contained in this table to fit any given case, as it is found that the efficiency of the lines may be greater or less than 93 per cent.

It will be seen from the appended table that the cost of operating electric heaters will depend upon the kind of engine employed and the cost of coal. For example, if coal costs $2 a ton of 2,000 pounds, and if the average consumption of current in cold weather is seven amperes, and if we take a compound low speed condensing as the average type of engine in point of economy in consumption of fuel, we will find that seven amperes for one hour will cost 1.17 cents.

From the reports which we have received, I find the average length of time a car is in service per day in the winter time is 15 hours. The cost of operating eleetric heaters with the average consumption of current in cold weather would, therefore, be 15 times 1.17 cents, which equals 17.55 cents for 15 hours. This cost does not allow for any depreciation in heaters as the three years of service of these heaters does not appear to have any effect upon the life of the conductors and not a single coil in any heater has ever been renewed in this length of time. So far as an examination of the coils that have seen three years of service can determine, absolutely no oxidation has been produced upon the wires.

As to the cost, now, of heating by stoves, I will say that I have a number of reports from different railroads in this state using stoves.

Taking the average made in the answers referred to, I find that 33 pounds of coal were used per car per day, costing $4.55 per ton of 2,000 pounds. This coal costs 7½ cents per day. The average cost of repairs per car is one-half cent a day. The average cost of dumping fires, removing coal and ashes before car is run out of barn, and coaling up and kindling fire in the morning, including the cost of kindling used and that part of cleaning cars chargeable to stoves, is 10 cents per day. The average cost per day of other expenses chargeable to stove not included in their figures, as cost of removing stoves for the summer, installing of the stoves in the fall, repairing of head linings, repainting, etc., averages 1¼ cents per day. Without adding anything to the cost of the stove for the space for one person occupied by the stove. I find that the total of the items so far aggregate 19¼ cents per car per day. It has already been stated that the extra cost of current based upon the cost of power necessary to heat a car with seven amperes of current on a 500 volt circuit aggregates 17.55 cents per car per day. This amount will be modified as different types of engines are used of different efficiencies, but I believe that on the average for the type of engine generally used it is correct. Other questions of greater importance, however, than the cost of the mere heating by electricity or stoves; which is as to the effect which electric heating has in inducing travel upon street car lines. It is, however, a difficult thing to determine in figures exactly what increase of travel takes place on account of having cars properly heated at all times and that heat being properly distributed through the car. I am not at this time prepared to give any figures or estimates based upon this point. I believe, however, that it is worthy of the consideration of managers of street railways in the matter of securing patronage for their lines.




CUP ARMATURE DYNAMO.

| TYPE OF ENGINE. | Total cost in hundredths of a cent of one ampere hour on 500 volt circuit delivered at the car. | Cost of coal per hour for heating a car with six consolidated electric heaters, on a 500 volt circuit, when switch is placed in different positions, as follows: | | | | |
|---|---|---|---|---|---|---|
| | | 1 Intensity uses 2.14 amperes. | 2 Intensity uses 2.88 amperes. | 3 Intensity uses 6.98 amperes. | 4 Intensity uses 8.09 amperes. | 5 Intensity uses 12.05 amperes |
| | Coal at $2 per 2240 lbs. | Coal at $2 per 2240 lbs. | Coal at $2 per 2240 lbs. | Coal at $2 per 2240 lbs. | Coal at $2 per 2240 lbs. | Coal at $2 per 2240 lbs. |
| | Cents. | Cents. | Cents. | Cents | Cents | Cents. |
| Simple high speed non-condensing | .84 | .64 | .86 | 2.10 | 2.4 | 3.62 |
| Simple low speed non condensing | .78 | .57 | .78 | 1.89 | 2.19 | 3.26 |
| Compound high speed non-condensing | .74 | .50 | .68 | 1.64 | 1.91 | 2.85 |
| Special triple compound high speed non-condensing | .72 | .47 | .63 | 1.52 | 1.77 | 2 63 |
| Simple high speed condensing | .68 | .43 | .58 | 1.40 | 1.62 | 2.41 |
| Simple low speed condensing | .64 | .40 | .54 | 1.30 | 1.51 | 2.24 |
| Compound high speed condensing | .66 | .39 | .52 | 1.27 | 1.47 | 2.20 |
| Compound low speed condensing | .62 | .36 | .48 | 1.17 | 1 36 | 2.30 |
| Special triple compound high speed condensing | .62 | .33 | .44 | 1.8 | 1.25 | 1.86 |
| Triple compound low speed condensing | .60 | .32 | .43 | 1.4 | 1.21 | 1.80 |
| Triple compound low speed condensing | .59 | .30 | .40 | .98 | 1.13 | 1.69 |
| Ditto for probable maximum results | .59 | .25 | .33 | .81 | .94 | 1.40 |

1. Including operating expenses and coal, supplies, repairs, wages, insurance, taxes, renewals, and 8 per cent. interest on the investment.

## Cup Armature Dynamo.

By Dr. G. H. Zahn.

Fritsche's (Berlin) new dynamo with its cup armature appears, in comparison with familiar types, as an entirely new form of continuous current dynamo. The principal parts of this new machine have the form of a cup, for which reason the name of cup armature dynamo has been chosen.

The armature, shown in Fig. 4, consists of a wrought iron core and copper coils like the dynamos generally built, but the core of the cup armature is laminated different from the ordinary type of machine. While the planes of lamination on ring, drum or desk, armature cores are parallel to the direction of rotation, in the cup armature the lamination is rectangular to the motion. This arrangement, the inventor claims, is an improvement in many ways.

The armature core is constructed in a most simple manner. It consists of a solid hub of cast-iron keyed to the driving shaft and a certain number of iron bars of particular form which are firmly held together by the hub and thoroughly insulated from each other. The star-like arrangement of the laminæ in the hub produces intervals between which the copper windings are driven. The commutator bars are grooved and fitted directly to the iron bars by soldering and riveting, and the connection of the armature windings with the iron bars is made in the same manner, thus securing a good and strong contact of the three different parts. The armature core built up in this way forms, with the hub, a complete cup, Fig. 4.

The armature coils, Fig. 5, are separately wound on a former, all exactly alike, and then fitted into position. The great advantage of this construction is a certainty of high insulation and ease of manipulation.

The field-magnet system is constructed in two parts, as shown in Figs. 1 and 2, for a six-pole machine. On the inner magnet core with its short pole pieces, the one exciting coil, Fig. 3, is placed, while the outer pole pieces form at the same time the frame of the whole dynamo. These two

parts of the magnet system are placed in such position that poles of different polarity face each other, and between these pairs of poles the armature is revolving. It is easily seen that the direction of the magnetic lines through the magnets, the armature core and the armature conductors, is rectangular to the direction of rotation. The iron bars of the armature being very close to the pole pieces, only a small amount of copper wire and current are required to excite the field.

The other details of the new Fritsche dynamo may be gathered from the cuts. The efficiency of these machines is very high, and by the particular form of the armature and field magnet system they can be adapted to very slow speed.

## Detroit Street Railway Track Laid in Concrete.

Track construction is one of the departments of street railway work that has seen marked advancement since the introduction of the trolley system. With a view of establishing a roadbed which will require the minimum outlay for maintenance the Detroit Citizen's Street Railway company has adopted the construction for its tracks which is herewith illustrated. The laying of track upon concrete has given satisfaction in Montreal and Toronto and will undoubtedly attract the attention of delegates to the street railway convention in the former city. The illustrations, which are taken from the *Railway Review*, show the method adopted for the Jefferson and Gratiot avenue lines in Detroit, in which it will be seen that the rail is of the girder type grooved and nine inches high, the section being 100 pounds to the yard. The track is held to gauge by steel ties which are from four to five feet apart center to center, and besides acting as tie rods these are supposed to assist in maintaining the surface of the track. It is doubtful, however, if they are necessary except in holding the track to gauge, which seems to be recognized by the management, as it is proposed that some of the track shall be laid with ties spaced at 10 feet centers.

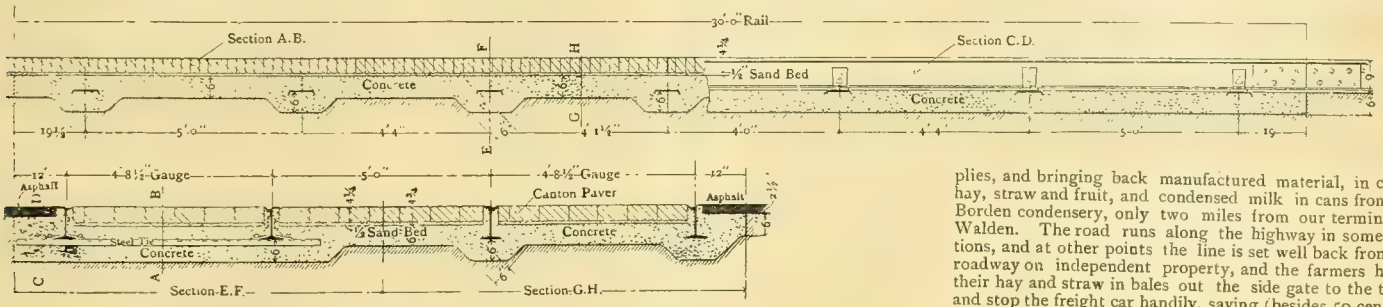



FIG. 1. DETROIT STREET RAILWAY TRACK LAID IN CONCRETE.

The sections show that the concrete comes against the flat base of the rail, the outline of the excavation being such as to bring the thickness of the foundation to a depth of six inches below every part of the rail and the tie. This applies also to the curved ties used on Gratiot avenue. Upon the top of the concrete a half-inch sand bed is spread which is surmounted by Canton pavers to be flush with the top of the rail. This pavement covers the space between the rails only, the paving of the remainder of the street being asphalt. The main point of difference between the arrangements of Figs. 1 and 2, is that the track on Jefferson avenue, Fig. 1, has electrically welded joints which constitute an experiment the success of which will depend upon the ability of the contractors to dress down the joints to a smooth surface after the weld is made. A new feature in this welding consists of compressing the rails by hydraulic power before welding. The greatest trouble anticipated from the welded joints is the danger of breaking in winter. It is expected, however, that the compression method will overcome this.

The track in Detroit which has been laid in concrete is giving satisfaction in every direction; the girder rail used is made by the Johnson company of Lorain, Ohio, and is a very good illustration of what can be done in the way of rolling straight rails with a fine finish when pains are taken to have this accomplished. The Detroit Railway company is also laying track on concrete, but instead of using ties it uses a spacing rod at intervals of about five feet. A prominent steam railway engineer who has followed this track construction very closely is reported to have said of the method: "There is no question about track laid on concrete being the proper thing for city streets. I believe that it is among the possibilities that track on concrete is the proper thing for steam roads. Its first cost would be somewhat more expensive than track laid on dirt or stone ballast, but I believe the maintenance expenses would be reduced sufficiently to more than offset the increased cost. Of course, such track for steam roads would be impracticable unless the mills furnish straight rails. They have been a long way from doing this in the past, but have been making great improvements recently."

## American Street Railway Association.

This year's convention of the American Street Railway association has been looked forward to with much expectancy by those interested in that organization. It is an important point in the history of the association, and the members realize that radical changes will be required to keep the organization up to the conditions required by the broadened and extended field of street railway enterprises of to-day. In view of the fact that the association will be called upon to select a new secretary, it is suggested that someone be chosen who can give all his attention to the matter and build up the organization. The association is strong in numbers and influence and its scope of usefulness could be extended by the selection of a man well qualified to direct its work. Of course the present officers cannot be asked to give their attention to this work, but it is claimed someone must be secured to do this work if the organization is to keep up with the times.

The preliminary programme and an outline of the arrangements for the meeting have already appeared in this journal. Nothing remains to be added to these announcements. The outlook is promising and there is reason for congratulation on all sides.

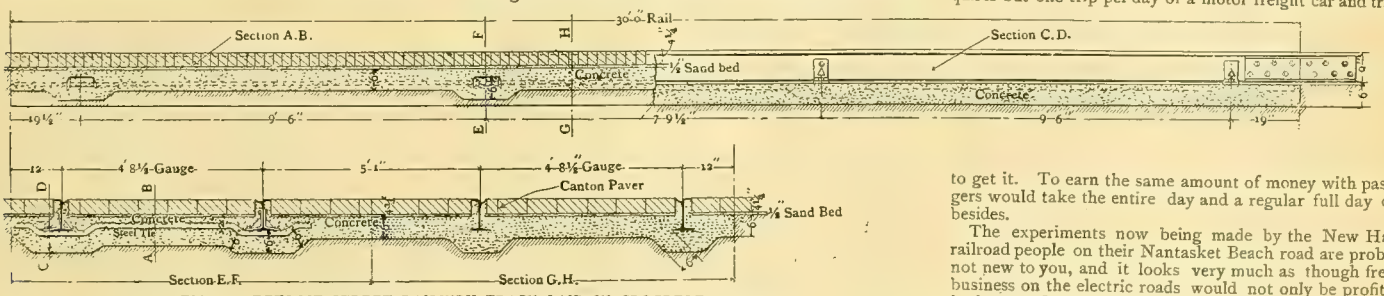



FIG. 2. DETROIT STREET RAILWRY TRACK LAID IN CROCRETE.

## Is a Freight or Mail Service Profitable or Unprofitable on Street Railways?[1]

BY BENJAMIN NORTON.

The simplest answer to this question is yes, if it can be performed at a profit, and no, if it must be performed at a loss. Now, apparently, the question is solved, and I have no further need to discuss it. But as this is a subject which will eventually be taken up seriously by most electric railway companies, it is worthy of very careful consideration.

On a street railway which has no suburban outlet and no direct or close connection with some other line which operates or can conveniently operate a freight service, it might be a very unprofitable venture to undertake this class of traffic. To-day, however, there is hardly an electric railway (and we will speak of electric roads only now, since horse power is a thing of the past) which does not have suburban outlets or chances for them. Therefore, we may safely say that a freight service, as a general rule, ought to pay. Very few companies thus far have branched out into this field, and as I happen to be interested heavily in a line which has gone vigorously into the matter, I can tell briefly our experience, and can show you what a successful feature of our business the freight branch of it is, so much so that we have a regularly organized freight department, waybilling merchandise in regular steam railroad fashion, and running regularly scheduled freight trains, all of which pays handsomely.

This line grew out of a tumble-down horse railroad in the city of Newburg, and after being rebuilt and extended and equipped electrically, we found ourselves tapping the rich Walkill Valley at Walden, 12 miles away, and terminating at the front door of one of the largest cutlery works in this country, running by all the stores and shops in town, and giving an opportunity besides to dairymen of Orange county to get their milk, butter and cheese to boats on the Hudson river at Newburgh inside of an hour, when formerly they had carted it the distance over the rough country roads, the teamsters spending pretty much the day at it and returning home at night, with their mule team tired out and often a broken down wagon.

This line to-day, because it is a short cut in the first place, and because goods can be transported at low rates, in the second place, is handling the dry goods and other merchandise for Walden merchants shipped from New York to Newburgh by boat, the raw material for the cutlery works in the way of steel, brass, wood and other supplies, and bringing back manufactured material, in cases, hay, straw and fruit, and condensed milk in cans from the Borden condensery, only two miles from our terminus at Walden. The road runs along the highway in some portions, and at other points the line is set well back from the roadway on independent property, and the farmers hustle their hay and straw in bales out the side gate to the track and stop the freight car handily, saving (besides 50 cents to $1 per ton freight) a long drive to the steam road freight house.

In the month of August the operating cost for handling our freight was a trifle over 40 per cent. of the gross receipts. We ran three motor freight cars, carrying from eight to 12 tons each, and four flat or gondola cars as trailers, carrying from six to eight tons each. At Newburg the line runs alongside the string piece of the steamboat dock, so that everything can be easily skidded between the boats and cars. We also run close to the Erie and West Shore freight houses and tracks, ensuring an all year-round New York connection, although as a rule the Ramsdell line of boats is out of service but one month in the year.

Some of our Walden friends remarked the other day that the Walkill Valley railroad people had soured on the trolley, because their freight trains in both directions were running through Walden without stopping, and they were discussing the notion of discharging their freight agent at that point. I may add that the past week we have hauled from Walden to the Hudson river, among other kinds of freight, about 75 tons of grapes, and the coming week we will do the same. The rate of 13 cents per hundred pounds net to us makes $2.60 a ton, which is a good rate, and requires but one trip per day of a motor freight car and trailer to get it. To earn the same amount of money with passengers would take the entire day and a regular full day crew besides.

The experiments now being made by the New Haven railroad people on their Nantasket Beach road are probably not new to you, and it looks very much as though freight business on the electric roads would not only be profitable in the near future but generally adopted as a means of revenue by a large percentage of such companies.

As to mail contracts, while the government compensation is comparatively small, the actual cost to a company for performing the service is so little that they must be profitable to a certain extent, but aside from this no large corporation in a large city where the circumstances call for such a contract should overlook a special safeguard in time of strikes. During my presidency of the Atlantic Avenue Railroad company in Brooklin we undertook to serve the government in this regard and prepared special cars. Part of these cars were devoted to mail matter and mail clerks, and part to regular passengers; so that while they were on the line they were earning money for the company from passengers, the same as other cars, and at the same time the United States mail sign always insured a clear track. Our experience during the strike of last winter proved conclusively the value of a government contract for carrying the mails. The 19 cars on our Fifth avenue line, which, by the contract, were permitted to carry the legend United States mail, were not molested, and we were able to keep that particular line open throughout the whole trouble. In view of all the circumstances, I believe a mail contract for a street railway is one of the most profitable things for a small one that they can undertake.

1. Read before the Street Railway Association of the State of New York, Albany, September 17, 1895.

The Chamber of Commerce building in Minneapolis has been damaged by fire caused by electric light wires, according to Fire Marshall Pierce. Ex-Inspector Deming condemned the wires some time ago, but the investigation showed that there had been current on them since that time.

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TO THE delegates and visitors assembled at the convention of the American Street Railway association at Montreal this week the WESTERN ELECTRICIAN extends assurance of its esteem and interest in their welfare. The members of this organization are progressive and public spirited citizens and they have done much to develop and maintain the advantages which residents in American cities enjoy. Their interests do not conflict with those of the people or the municipality, but where properly administered contribute largely to the public comfort. We trust that their deliberations on this occasion will be marked by the same conservative spirit that has heretofore governed the organization. We hope, too, that they will enjoy the social features of the meeting and that the gathering will prove in every way satisfactory to them.

THIS number of the WESTERN ELECTRICIAN goes to press earlier than usual in order that it may be ready for destribution at the Montreal convention. It is devoted largely to the consideration of street railway matters, and special attention is directed to the leading feature, which is none other than a description of the penetration of Chicago's down-town business district by the overhead trolley system. After years of struggle against overhead wires in this district the business men and property owners of South Clark street have come to the conclusion that their interests demanded that they modify their views and permit the construction of a trolley line, as they have been convinced that it is the only modern railway system that is practical in that congested district. It is certainly a notable victory, and street railway men throughout the country will not be slow to recognize the advantage gained.

THERE must be some probability that the experimental roads now in operation in New York and Washington will prove the practicability of the underground conduit type of street railway construction, otherwise the "inventors" of the earlier forms of this construction would not be so anxious to take up the subject again and bring forth their dust covered patent specifications in support of their claims of priority. Already actions have been instituted and others are threatened, alleging infringement of fundamental patents, the existence of which had been forgotten, if indeed it was ever known to the electrical fraternity generally. It is remarkable the amount of litigation required to develop and demonstrate the practicability of any special form of construction in electrical work.

IN these days people go to the theater to see deeds of daring and applaud mock adventures. They are content to have a stage representation of the feats performed by Robin Hood, Little John and their followers in Sherwood Forest; that is near enough. They don't want a nineteenth century version enacted on the trolley road on their way home going through "Berwyn Forest," nor do they wish to be participants in such stirring events to the extent of giving up their valuables to modern banditti. That is bringing it too near home, and it removes the enchantment of the scene. It is so different from a spectacle seen in a comfortable theater. Then, too, the modern imitator of Robin Hood is not as dashing as the hero of Sherwood Forest; he is more exacting in his demands and not the least attractive in his manners. The good people of "Evingstung" don't like him, and they will refuse to ride on the trolley cars unless the company induces the police to lock him up safely where he can not bother suburbanites. The company must see to it that the outrage committed on its patrons on Monday evening, October 7th, is promptly and properly punished.

"NATURAL monopoly" is a term that is being applied to everything nowadays that populists and socialists wish to bring within direct control of federal, state or municipal government. The telegraph, railroad, electric light and street railway are looked upon as coming properly within this classification, but until the public service and the administration of public affairs generally are divorced from politics there will always be strong ground for opposition. In Chicago the municipal government is marked by inefficiency in every department, each change in administration bringing out public scandals that disgust and sicken honest men. The street department and the water department, two important public bureaus often cited, are badly managed, and there is corruption on every side, according to the men engaged in public affairs. Then why should other enterprises be entrusted to such men?

The management of Brooklyn bridge is another favorite illustration cited by enthusiastic advocates of socialistic principles, and this is about as unfortunate as the other examples of municipal control presented for public examination. New York daily papers of every and no political shade and tendency constantly score the management of this great enterprise for inefficiency. A private corporation would not dare to conduct a similar enterprise on the loose, unbusinesslike and unsatisfactory plan that has marked the history of the big bridge. There is always something wrong, and the management keeps the people of the two cities constantly irritated and annoyed. Just now a vigorous protest is being made against the bridge car service, but it seems to make no impression whatever on the board in control. The New York *Tribune* says: "The plain truth of the matter is that the slowness of the Brooklyn bridge trains is a disgrace both to New York and to Brooklyn. If the Brooklyn bridge had been managed from its opening with intelligence, with ability and with enterprise, a far better and swifter system of traffic would have been devised and put in operation long ago." Thus it is wherever we turn. Public business is neglected where political influence rather than fitness is considered in the selection of men in charge, and the result can easily be imagined. Then why add to the general discomfort? Let us have no more experiments.

ONE of the latest reports from the territory of the Wisconsin Telephone company indicates that the Bell interests are at work on the old lines, endeavoring to choke competition and resorting to every known device to prevent new companies from gaining a foothold. The following press dispatch from Oshkosh is a fair sample of many that have been received lately from that section:

The prospects are good for a very lively telephone war in this city. The new Northwestern Telephone company's plant is nearing completion and the Wisconsin Telephone company is preparing a grand coup to embarrass, if not drive out, the new company. Manager Gallagher of the old company says they will give the cheapest service if they have to furnish telephones one year for nothing. The new company charges $18 for houses and $30 for offices. The old company's rate is $24 and $36.

No one objects to the old company running its business to suit itself. That is its own affair. But it cannot object to competing companies taking advantage of its mistakes and profiting by them. Of course, if the Wisconsin Telephone company desires to give free service to the people of Oshkosh for a year, every resident of that city should take advantage of the offer and apply at once for telephone service, and the competing company might assist the old concern in getting additional names. The "free service" field being once opened it could be extended throughout the entire territory controlled by the Wisconsin Telephone company. The people of Milwaukee will be interested in this matter. They have been trying to get a reduction of telephone charges, but the company has been reluctant to yield to their demands. Now, they may claim the same consideration as the people of Oshkosh, and as long as the Wisconsin company is in the "cut-rate" business, it may as well be prepared to furnish free service everywhere in its territory.

It will not require much deliberation to realize that such a policy must be followed by ruinous results. To conduct a war on such lines the company must be prepared to enlarge all of its exchanges, extend its line equipment in every direction and be ready to keep up this sort of thing indefinitely. Of course, the end of all this would be bankruptcy for the company engaging in it. No good can come from such a policy. It would be much better for the Bell interests to scale down their rates to a reasonable figure, improve the service, meet the demands of the subscribers in a fair spirit and furnish service on its merits. Mr. McLeod has been in the telephone business long enough to learn that the policy his agents throughout Wisconsin are contemplating can only result in financial disaster.

AN American traveler who attended the recent meeting of the British association makes an interesting comparison between the speakers on that occasion and the popular speakers who addressed the English workingmen shortly before. He says that among the leaders of the various sections of the association there are few good speakers, and then he goes on to say that he could not help contrasting the oratory as he passed from room to room, with that which he had heard only a fortnight before at the Trades Union congress at Cardiff. The labor leaders, he remarks, know nothing about science, but they understand the art of speaking without hesitation and circumlocution, and know how to hit the mark. The educated professors, with few exceptions, do not speak well. "They have a halting, hesitating manner, are constantly 'hemming' and 'hawing' and changing the construction of their sentences. An accurate phonetic transcription of speeches delivered at this session would be a curious and amusing study. It would be punctuated with sighs, ejaculations and groans, and would be a veritable maze of mixed constructions and circumlocution. There are some excellent speakers among the regular attendants at section work, but the majority of them are careless and slovenly talkers to whom it is almost painful to listen." The same criticism might be made of many American gatherings. Not enough attention is given to the art of public speaking, especially among scientific men. This may be due in part to the fact that they have grown accustomed to reading their addresses or papers on scientific subjects. Then when they are called upon to explain or defend some point they often hesitate about delivering an opinion off-hand. But in assemblages that are not strictly scientific meetings, where the commercial and scientific elements are blended, like some of the American gatherings, many good speakers appear, although it must be confessed that most of them are from the ranks of commercial men.

During the meetings of the World's Congresses in Chicago, World's Fair year, the college professors were numerous but not eloquent. At the meetings of the several electrical societies and associations in this country the best speakers are not college professors, but men who are brought into contact every day with the commercial world, and who are accustomed to convey their ideas clearly, concisely and forcibly. They are not always polished speakers, but they are interesting talkers. They have something to say and they know how to say it. A good deal of the "hemming" and "hawing" which college professors indulge in seems very much like affectation, but just why any intelligent man and especially an educated man should cultivate such a halting and hesitating manner is beyond comprehension. Some of these college professors should study the methods of their less profound but by far more interesting and instructive friends in trade. We advise those who can, to go to the Montreal convention, for instance. There are always plenty of good speakers among street railway men, and we venture to say that their remarks on that occasion will be well worth hearing.

## The Passing of John Provident Barrett.

Editor Hornsby seems to have constituted himself general sponsor and chief apologist for his friend and patron, "Professor" Barrett. Well, brother Hornsby, we can say this to you: If you do the work thoroughly, your hands will not lack for occupation nor your paper for copy. In undertaking this task you enlist our sincere sympathy. When you have satisfactorily accomplished it your previous achievements will seem small in comparison.

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Barrett & Hornsby's "educational" journal desires to know from us why, if the public plants under Barrett are so inefficient, "committees and commissions from all parts of the world are constantly sent to Chicago for pointers on prospective work." The answer is simple enough. Chicago is a big city and has many model private electrical enterprises thoroughly well managed and worth going many miles to see. The assumption that the committees all come to Chicago to see Barrett is characteristic of that egotism which seems to reach its highest development in an ignorant mind. Certainly these outside investigators do not get any satisfaction when they go to the city electrician for information. Those foolish enough to try for knowledge there have retired in disgust, as witness the Milwaukee committee and certain members of the National Electric Light association. But the latter did not fail to make clear their opinion of the Chicago public lighting plant.

## Alleged Infringement of Underground Electric Railway Patents.

Elias E. Ries of Baltimore and Albert H. Henderson of Philadelphia have instituted legal proceedings against the Metropolitan Traction company of New York and the Metropolitan Railroad company of Washington for alleged infringement of patents relating to underground conduits for electric railways. The bills of complaint were filed in the Circuit Court for the Southern District of New York on September 17th and in the Circuit Court for the District of Columbia on October 3d. It is alleged by complainants, in substance, that the electric conduit railway recently constructed for the Metropolitan Traction company and now in regular operation on Lenox avenue in New York city, as well as the underground conduit railway built by the Metropolitan Railroad company and in operation on its Ninth street line in Washington, constitute direct infringement and violation of patents granted to Elias E. Ries and owned by the complainants, covering essential features which are used in the construction of the roads in question, and upon which their practicability and successful operation depend. The patents upon which suit has been brought and which it is alleged are infringed are seven in number, as follows:

388,556—Conduit for electric and cable railways. Granted March 23, 1886.

370,283—Underground conduit for electric and other railways. Granted September 20, 1887.

383,770—Underground conduit and collectors for electric railways. Granted May 28, 1888.

386,085—Electric railway. Granted July 10, 1888.

386,087—Combined electric railway and wire conduit. Granted July 10, 1888.

409,756—Electric railway crossing. Granted August 27, 1889.

409,757—Underground conduit for electric railways. Granted August 27, 1889.

The applications for the inventions enumerated were filed in the United States Patent Office by Ries and Henderson at a very early period in the history of the electric railway industry, and the complainants contend that the group of patents issued thereon were among the first ever granted by the United States government on this subject. According to Messrs. Ries and Henderson they fully describe the underground electric railway system now used in New York and Washington, and ante-date about everything done in this line in the United States as well as in Europe. Mr. Ries calls particular attention to the fact that an illustrated description of one of the patents sued upon, No. 370,283, was published in the WESTERN ELECTRICIAN for October 8, 1887, from which, he says, it will be observed that there is "great similarity between this and the infringing conduits finally adopted by these companies as the most practicable form." He adds: "It will also be noted that this description was published nearly two years before the opening of the first successful conduit line at Buda-Pesth."

## Trolley Parties Profitable in Philadelphia.

[From the *Philadelphia Press.*]

The full extent of the trolley party infatuation and the number of persons who have engaged in it is shown by the receipts of the four companies up to October 1st. The amount received by the People's Traction company is $17,000; the Philadelphia, $30,000; Electric, $20,000, and Hestonville, $3,000, or $70,000 in all. The average amount received from each participant is estimated at 10 cents, and this would show 700,000 persons who indulged in this amusement.

## Victory for Western Electric Company in Important Patent Litigation.

The final decision of the United States Circuit Court of Appeals for the seventh circuit in the suit of the Thomson-Houston Electric company against the Western Electric company and Enos M. Barton concludes one of the most important patent causes relating to electrical inventions.

In 1879 Elihu Thomson and Edwin J. Houston applied for a patent upon an automatic adjuster for commutator brushes of magneto-electric machines. In this patent the applicants described and claimed a device for automatically adjusting the brushes upon the commutators of dynamo-electric machines, "whereby an automatic adaptation to variations of circuit resistance is secured." This device consisted of a relay adapted to bring into service a motor which shifted the brushes upon the commutator. The relay received its current from an accessory brush placed in advance of the main brush upon the commutator of the dynamo-electric machine.

The patentees of this "first" patent, which was issued as No. 223,659, July 20, 1880, testified that up to the time of taking out of this patent they had not made the invention of current regulation and did not appreciate that the brushes upon the commutator of a dynamo-electric machine could be shifted so as to keep the current constant. Whether this is so or not, the fact remains that it was known to electrical engineers of that date that shifting the brushes upon the commutator of a dynamo-electric machine could be so performed as to keep the current flowing in the circuit constant notwithstanding the variations of the resistance in the circuit. Weston testified that he had manually shifted the brushes for this purpose from 1876.

It was not long after the issue of this patent, No. 223,659, that Thomson and Houston discovered their failure to cover the device broadly for automatic current regulation. A second application upon substantially the same apparatus was therefore filed and this patent, called generally the "second patent," had broad claims upon automatic brush-shifting current-regulation. It was this second patent, No. 238,315, upon which suit was brought against the Citizens Electric Light company of Boston, users of Wood arc-lighting apparatus. A decision was secured in this suit in August, 1888, sustaining the validity of Patent 238,315 and finding the defendants, users of the Wood regulator, to be infringers. Suit was subsequently begun against the Western Electric company in the United States Circuit Court for the Northern District of Illinois, and, after years had been spent in collecting evidence, the case came to hearing in June, 1894, before Judge Grosscup, who rendered an opinion adverse to the patent early in the present year. From this decision of Judge Grosscup the Thomson-Houston Electric company appealed to the Circuit Court of Appeals. The case was elaborately argued in June of the present year and the Circuit Court of Appeals has just handed down its opinion, affirming the decision of Judge Grosscup. The statement of facts occupies some 46 large pages of the opinion of the Court of Appeals and comprises voluminous extracts from the testimony of Charles E. Scribner, the main witness for the Western Electric company and one whom the Court of Appeals describes as an expert of conceded intelligence, skill and accuracy.

In addition to the defense which was most strongly urged, namely, that of the first Thomson-Houston patent, No. 223,659, which showed substantially the same device as that of the later patent, No. 238,315, upon which suit was brought, the invention of Maxim of an automatic current regulator for dynamo-electric machines which was applied to separately excited dynamos running incandescent lamps in multiple arc, was urged as an anticipation of the patent in suit, and it will be observed from the opinion of the court that this defense also was considered to be adequate to defeat the broad claim of Thomson and Houston for automatic brush-shifting current-regulation.

The Western Electric company, which defended this case at the expense of much time and money, is to be commended for its pluck and intelligence. At the beginning of this litigation, after the decision by Judge Colt sustaining the patent, the outlook for a successful defense was fuliginous in the extreme. The competitors of the Thomson-Houston Electric company, some of whom were courageous in undertaking patent litigation, almost unanimously preferred to surrender and sell out to the Thomson-Houston Electric company, or to go out of the electric lighting business, rather than undertake the defense of this suit. The Western Electric company in conducting this defense, therefore, had to contend not only with the prior decision in favor of the patent, but also with the almost universal acquiescence of the public in the claims of this patent, which claims have now been authoritatively found to be, as the Western Electric company all along was convinced, unjust and inequitable.

The opinion of the court as delivered by Judge Woods is as follows:

We are unable to find in the current regulator of the patent in suit anything more than an adaptation of the brush adjuster of the earlier patent. The two are essentially the same in mechanism, adjustment, motive power and law of operation, and in so far as the purpose intended, or accomplished, are not the same they are distinctly analogous. The second patent purports to be only an improvement upon the first, "the method" of which is declared to be "adaptable to the present case of current regulation." As first drawn, the specification declared the correspondence of figure 2 of the present invention with figure 2 of No. 223,659, with the explanation that, since a single pair of collecting brushes when placed upon an obliquely-slotted commutator replaces the double pair of the earlier design, the contact-making magnet, of that invention is placed in the main circuit of the machine so as to act substantially in the same manner as the magnet in figure 1, of that patent; "that is, by variations of the main current." By the specification as it stands the patentees say: "As in our former invention, already referred to, the motor device used may be adapted to move by the current, or by the motive power, or by suitable clock-work, or by other mechanism adapted to be thrown in or out of action by an electro-magnet, and constitutes, as before, a minor feature of our present system. Our present method of operating, so far as it relates to automatic regulation, is based upon the same principles of operation as our previous invention; and it consists in an improved construction and mode of use of the apparatus employed in patent No. 223,659." But as the present method relates entirely to automatic regulation, it follows that if the patent shows invention it must be solely "in an improved construction and mode of use" of a known apparatus which, notwithstanding the improvement, is to operate upon the same principles as before. In just what feature of the construction or of the mode of use the novelty and utility, entitled to be called invention, were supposed by the patentees to be found, is not specified and can only be inferred. According to the brief for appellant, "the improvement consists in discarding the accessory collector, with its intermittent, uncertain, feeble current and unstable adjustment, and substituting the simple, practicable and effective combination of the controller magnet and main current." "In both inventions", it is said on another page "the brushes are mounted on a rocking yoke so that the "positions of their points of contact with the commutator can be shifted; in both of them the result sought is obtained by so shifting the brushes; in both of them this is accomplished by a motor mechanism which is automatically set into operation in one direction or the other as the case may require, by a controller mechanism which acts in response to the abnormal conditions which are to be corrected. Here the similarity between them ends, and the dissimilarity, both in mechanical construction and mode of operation, begins. The taking away of the accessory collector changes the structure and introduces a new mode of operation; * * * for the reason that the current which actuates the controller magnet of the spark adjuster is not the main current, or any part of it, but a different current derived from a different source."

In its last analysis the argument for the appellant ends in this assertion, that magnet A of the earlier patent is not excited by the main current of the machine or a shunted portion thereof, but only by a different current derived from a different source, "flowing intermittently, and sometimes in one direction and sometimes in the other." The truth of this proposition is disputed, and, though it is supported by the statement in the specification, that "the accessory collector $C^2$ serves, as it were, the purpose of a feeler, the design of which is to test the electrical condition of the segments of the commutator at the moment of leaving the collectors, and to originate from that condition an adjustment of said collectors in whatever is necessary to secure efficient action," it does not seem to follow, necessarily, that no current was intended to pass through the controller magnet A except current resulting from the difference of potential between successive segments at the moment when the forward one passes from under the accessory brush. That is not declared to be an essential feature of the invention, and instruction is not given in the patent for so constructing the different parts of the combination, or for so proportioning the resistance in the main and accessory circuits as to produce that result. On the contrary, it is shown to be a delicate and, except with the experienced and skillful, a difficult work to make an adjuster through whose controller magnet no portion of the main current shall flow, and which shall be operative under the supposed intermittent or pulsatory current which is intended to be taken up by the accessory brush. Indeed, the objection urged against the experimental spark-adjusters constructed by the defendants in professed conformity with Fig. 2, of patent No. 223,659, is that the resistance of the accessory circuits was made so low as to permit the constant passage of a distinct part of the main current; and on that ground the experts and counsel of the appellant are agreed in asserting that the exhibits were really current regulators, embodying the invention of the patent in suit and not the invention of the other patent. The uncontroverted testimony of Professor Cross, examined in behalf of the appellant, is to the effect that it can be determined whether a brush-regulator, constructed in apparent conformity with Fig. 2, of patent No. 223,659, is in fact a spark adjuster under that patent or a current regulator under the patent in suit only by the experimental employment upon each apparatus of tests adapted to show whether or not an appreciable and effective portion of the main current passes through the accessory circuit. This alone ought to be conclusive of the dispute. When such tests are necessary to distinguish one such device from another, it is manifestly an impracticable, not to say dangerous, proposition that the making or using of either under a given patent may be declared to be an infringement of a different patent upon the other.

It being admitted that if the construction of the brush adjuster under No. 223,659 be such that a distinct portion of the main current will pass through the controller magnet the device becomes a current regulator, it follows that in respect to the question of invention the omission of the ac-

cessory brush is of no significance. Its presence or absence does not affect essentially the mode of operation nor determine the character of the device.

But, waiving other considerations, we will assume that the 10 propositions of counsel for appellant are true, that the appellant's theory of the process of short circuiting is correct, that the accessory brush of No. 223,659 is not a member of a compound brush, designed to assist in the process of commutation, but a mere feeler which finds and takes up the residual current or difference of potential which remains after imperfect work by commutator brushes proper. Does it follow that the current regulator of No. 238,315 is an essentially different device working upon a different principle? We think not. The specification, as we have seen, says that the principles of operation are the same. In physical structure they are alike, and both practically and theoretically they operate in like ways to effect like purposes. The proof is distinct and undisputed that upon all dynamos which existed when the patents were issued the two devices were interchangeable, so that when the brushes were so moved as to prevent spark they established and maintained constant current, and vice versa. For all possible purposes then known each device might have been called with equal propriety a spark adjuster (though that name is of later invention) or a current regulator. In dynamos of later construction, however, the points at which the brushes prevent spark and establish constant current are not coincident, as they were in the earlier machines, and that being so the brushes of a spark adjuster, it is conceded, will move to the place of no spark, regardless of current, while in the current regulator, responding to the current to be regulated, they will seek the point of constancy regardless of spark, and hence, it is insisted, the two devices are essentially different in their modes of operation and in the purposes to be accomplished. The force of this reasoning is very much weakened by the further fact, which seems to be undisputed, that neither the adjuster nor regulator, when constructed according to the patent covering it, can be successfully used upon dynamos of irregular or non-uniform fields in which the points of least spark and constant current are not quite nearly coincident. In order to avoid this difficulty commutator brushes, applicable alike to the brush adjuster of No. 223,659, and to the current regulator of No 238,315, were devised and so adjusted as to have a variable spread, corresponding momentarily with the strength of that portion of the field within which the process of commutation should be going on. Both devices being capable of adaptation by the same means to dynamos of non-uniform field, and when so adapted effecting, as they did upon uniform dynamos, the same results, the inference is strengthened that in their law of operation, as well as in mechanism, they are essentially the same. The discussion of the question has been varied and exhaustive, but along whatever lines pursued the argument has come back to the difference between the currents which are supposed to pass through the respective controller magnets. That difference we concede, but do not deem it controlling. One current is constant, the other is intermittent or pulsatory, but the pulsations are so frequent that the current seems to be constant, and its effect in energizing the magnet is the same as if it were. It differs practically from the main current only in strength. In order to be effective it must be strong enough to cause the magnet to overcome the counteracting spring, or, conversely, that spring must be so weak as at the proper time to be overcome by the strength of the magnet. If, instead of being in the accessory current, the magnet be transferred to the main current or a shunted portion thereof, exactly the same kinds of operation, effected in the same way and by like adjustments, must go on. In both constructions the levers, springs, armatures, magnets, brushes and dynamos are or may be the same; the electrical currents, whether coming from one part of the machine or another, are alike; and acting by one and the same law they differ only in volume or energy. The magnetic current, it may be said here, as in Western Electric company vs. Sperry Electric company, 7 C. C. A. 164, 18 U. S. App. 177, is not in itself a part of the device or invention any more than a current of water is an element of a water wheel. The invention is in the mechanism, not in the power which moves it, and once a device has been patented it is protected for all uses or functions of which it is found to be capable, whether anticipated by the patentees or not.

It is not difficult to suggest the employment of appliances for the control of water power in a way to illustrate not inaptly our view of the present question. The current of a stream is accumulated by means of a dam, and through head gates is turned into a race or flume whereby it reaches and turns a wheel to which is geared the machinery of a mill or factory. That wheel, for the purpose of illustration, is magnet M of the patents, the head gates are the commutator brushes, and the water flowing through the flume or race is the main current. First we will suppose that it is desired to maintain in the reservoir, by automatic means, a constant level or head, without waste or overflow at the dam: How shall it be done? With patent No. 223,659 before us the answer is plain. It may be accomplished by such a construction of the dam that whenever there shall be an overflow the surplus will, by means of another flume and head gate or valve, corresponding to the accessory brush, be turned into and made to move a second wheel, representing magnet A, connected with suitable mechanism adjusted to lift or lower the head gates in main current so as to effect the purpose of restoring the normal level in the reservoir. Theoretically at least, head gates or valves in water flumes might be adjusted and controlled in that way. Next we will suppose it to have been found desirable to establish constancy of current in the main flume or head race. How shall that be done? If constancy of head in the reservoir could be maintained it is evident that the desired constancy of current would follow as effect follows cause. They are coincident facts, and if that coincidence could be permanent no additional or different mechanism would be necessary. But the overflow current is intermittent and sometimes feeble and inefficient. When the stream is swollen it is strong and lifts the gates too high, and if the stream runs so low that it becomes necessary for a time to draw down the reservoir in order to obtain the desired current in the flume the overflow disappears and does not act at all. Does it require invention to devise a remedy? Clearly not. One familiar with the existing device could not fail to see that in order to effect the new purpose it was only necessary to make the controller wheel constantly and efficiently responsive to changes in the current to be regulated, just as Thomson & Houston, once they had found constant electrical current desirable, immediately proposed, as Prof. Thomson himself has testified, "to accomplish the necessary shifting or movement of the commutator brushes by automatic means in something the way that we had before used in adjustment through a limited range, only that we saw clearly that we must make whatever small variations the current in the main circuit underwent during the cutting out or on of lamps act to control the position of the brushes through a considerable angle around the commutator; and this could be done by a sensitive magnet in the main circuit setting in motion through contacts a device which should do the main work of shifting the brushes." In other words, it was only necessary to put magnet A in the main current or a shunted portion of that current, and that, it was evident, could be done without any change of structure except what was necessary to cause a diminution of resistance in the accessory circuit or an increase of the resistance in the main circuit, either of which could be accomplished in a number of ways explained by the witnesses. It was a plain case of mere adaptation to a modified but analagous use. In the illustration supposed the water-wheel in connection with mechanism employed to move the head gates in order to maintain constancy of level and to prevent overflow may well have been patentable as an original combination, but it is not an additional invention to turn into that wheel a different or additional current by force of and in response to which it will by the same mechanism move the gates or valves over a wider range, if need be, to keep in the flume a constant current, instead of a constant level in the reservoir. No new law or mode of operation is brought into play, and at most only improved and enlarged action is effected.

But the current regulator of the patent in suit, it is said, has gone into extensive use, and we are met with the usual inquiry, why if there is no invention in it did not somebody else make the same or like improvement upon the earlier construction? It would be enough to answer that it done by anybody else than Thomson and Houston, or their assignee, it would have been an infringement of the first patent. However, it was done by Maxim, in whose patent No. 228,543 the controller magnet is placed in the main circuit, and though the collector brushes moved thereby are not upon the commutator of the dynamo from which the current of that circuit is derived, but upon a second dynamo employed for the purpose of exciting the field of the first, the effect of the adjustment being to maintain a constant field and thereby to establish the desired constancy of current, the employment of the second dynamo does not disguise the fact of automatic regulation of the commutator brushes in the manner and by the means of the Thomson-Houston patents.

If the patent now in suit should be upheld it would be, in our opinion, an unwarrantable prolongation of the just monopoly conferred by the first patent, which, notwithstanding the strenuous efforts made to minimize it, we deem to have been of great merit and entitled to liberal construction.

The legal talent employed in conducting this case comprised many well-known patent attorneys, including F. P. Fish, R. S. Taylor, George R. Blodgett, C. K. Offield, H. S. Fowle and C. C. Linthicum of counsel for appellant, and George P. Barton and Charles A. Brown of counsel for appellees.

## Philadelphia Street Railway Lines Consolidated.

On October 7th the big traction amalgamation was consummated at Philadelphia in which three extensive local street railway systems—the Philadelphia, Electric and People's—were joined, under the title of the Union Traction company of Philadelphia. All the necessary papers have now been executed and the lease of the Philadelphia Traction company to the Union company has been signed by John Lowber Welsh and Peter A. B. Widener, the presidents. The deal was virtually effected two months ago, but since that time obstacles have arisen in the negotiations which prevented their consummation, but the last stumbling block has now been successfully encountered, and the three big lines forming the most extensive surface street railway system in the country will be operated under one executive head.

By the terms of the lease the Philadelphia Traction company, including all its allied lines, controlled or owned, is leased to the Union Traction company for 999 years, the Union company to assume virtually all the obligations now binding on the Philadelphia company, and to pay to the latter company a rental which will yield dividends of 8 per cent. a year to the stockholders. All that is now necessary to carry the triple agreement formally into effect is the action of the stockholders of the People's Traction company on the question of reducing the capital stock so as to come within the provisions of the act of the Assembly. This will probably be done on October 25th.

The deal just ratified forms what is probably the greatest single system of street roads in existence, with about 425 miles of road now operated and a combined capitalization in stock and bonds, including those of all the subsidiary companies, of more than $108,000 000.

## Changeable Electric Headlights.

The Central Electric company has recently secured the general western agency for the changeable electric headlight made by the Changeable Electric Headlight company of Syracuse, N. Y. These headlights are quite novel. The advantage of this headlight is that but one headlight to each car is necessary and no switches are required for the headlight circuit, as is the case with all other forms of electric headlights.

In the accompanying cuts is shown the receptacle, Fig. 1,

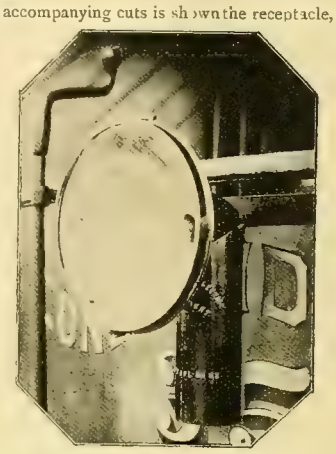


FIG. 2. CHANGEABLE ELECTRIC HEADLIGHTS.

fastened to each dashboard. In Fig. 2 the headlight is shown in position. The receptacle for the headlight is arranged with large and strong contacts, making disarrangement improbable. The receptacle is waterproof, durable and sightly. The headlight requires little room, being compact and of unique design. By the use of this form of headlight, the same advantages as those to be had with the ordinary oil headlight are obtained, while the expense of oil, broken chimneys and necessary care is done away with, reducing cost to a minimum and increasing the light to a maximum. They are said to be far more convenient than any other form of electric headlight.

The Central Electric company, Chicago, will carry these headlights and receptacles in stock, complete with all attachments. It has a fine sample on the display board, which readily demonstrates the practicability and utility of the device.

These headlights are finished in any color to match the cars and, added to the already complete line of railway appliances, puts the Central company in a position to meet

FIG. 1. CHANGEABLE ELECTRIC HEADLIGHTS.

all the demands of railway people with prompt and careful shipments.

Anent the stock carried by the Central Electric company, a good story is related by one of its salesmen. He had just taken an order for 20,000 feet of weather-proof wire.

The man making the purchase had been through the stock of the company and was acquainted with its immensity. His brother and partner, however, inquired of the salesman, "Can you fill that order from stock?" His brother turned to him with this remark: "Good gracious! man, they have more wire in their cellar than you ever saw in your whole life." It is hardly necessary to add that the order was shipped promptly.

The village of Rushford, Minn., has raised the amount asked by the telephone company to guarantee a telephone line being built and it is now promised a telephone connection with the county seat, La Crosse, and St. Paul this fall.

## Adams-Bagnall Lamp.

During the first part of May there was published in this journal an account of the formation of the Adams-Bagnall Electric company of Cleveland, Ohio, and it was remarked at that time that as far as was known no electrical company had ever before been organized so well equipped with specialists. Not a word has since been received from this company, until last week, when the accompanying cut and description of the company's arc lamp were received. It is evident that the experts of the company have been busily engaged and that they are now prepared to make good their promises. Heretofore, it may be remarked, the term "arc lamp" has carried with it an idea on ungainliness—a device having no form or shape and strung out over 45 to 50 inches of space divided up into sections of chimneys, rods, globes and sheet-iron drums—for reasons known only to the manufacturer. The trade has always looked upon an arc lamp as a necessary evil. The demand for something better has been universal. It is believed that the arrangement adopted by this company will overcome these objections.

The A.-B. arc lamp is only 32 inches long over all and burns from 14 to 18 hours. It is a single carbon lamp with only one side rod which causes one shadow only to be thrown. This shadow can be taken care of against the pole or building, leaving the light intended for the street entirely unobstructed.

A valuable feature in the operation of the lamp is the cut-out. It is well known that there are some standard lamps on the market which operate and cut out perfectly at any reasonable number of amperes, provided that the lamp has previously been adjusted for the special number of amperes. The A.-B. lamp will operate and cut out perfectly at any number of amperes f om five to 10 without any adjusting whatever. The accomplishment of this feat makes it feasible for the station manager to run either 1 200 or 2,000 candle power lamps to suit his convenience, with no change excepting the ampere output of his dynamo. Since the invention of the cut-out itself some 20 years ago no step in its development has been of such importance. Second in importance only to the feature just mentioned is the fact that the series lamp can be changed instantly into a constant potential lamp and that again into an alternating lamp simply by an exchange of spools. All of the working parts of each lamp are mounted on one frame which is attached to the lamp casing by a single bolt and nut. By loosening this nut the working parts of the lamp are removed and those of another substituted. One style of lamp only need be carried in stock by the station manager and with the addition of several kinds of spools he will be prepared to furnish a lamp for any kind of circuit.

ADAMS-BAGNALL LAMP.

The "A.-B." lamp will be furnished in any finish desired, whether black japan, yellow brass, seventeenth century brass, oxidized brass, oxidized copper, oxidized silver and aluminum. This provides an arc lamp good enough to hang in a parlor, it being possible to match any style of gas fixture or decoration. The aluminum lamp weighs only 19 pounds complete. The casing being of cast-iron provides a solid background for ornamentation, giving the lamp a dignified, substantial appearance.

The A.-B. lamp is the direct result of several months of close study and application by the engineering corps of the Adams-Bagnall Electric company, headed by T. E. Adams the well-known inventor of the Brush-Adams lamp. The results obtained point to a lamp which will certainly take its stand at once among the leading lamps of the day, which assuredly means success for the new company.

The A.-B. iron hanger board is another product of this company, which shows what can be done when intelligent engineering ability is applied to needful devices. This hanger board will cut itself in again, should a lamp go out accidentally. It complies with all the rules of the Board of Fire Underwriters, which are quite rigid. The officers of the Adams-Bagnall Electric company are as follows: Charles G. Hickox, president; George W. Howe, vice-president and treasurer; L. H. Rogers, manager; S. E. Cox, secretary; C. W. Phipps, superintendent.

## Severe Test for Electric Railway Equipment.

Car motors are occasionally put to severe usage, and as adversity is said to prove the worth of friends, so hard usage may be said to test the value of motors. The accompanying illustration, made from a snap-shot photograph, shows what a trolley may at times encounter. During last spring freshets invaded Middletown, Conn., and for some days the water stood for 12 to 18 inches on certain streets through which the line of the Middletown Street Railway company runs. The behavior of the motors is described by E. W. Goss, superintendent of the road, in a letter to the General Electric company, which furnished the equipment. He says, by way of explanation, that the photograph was taken by a resident of Middletown, who was impressed by the novelty of a street car running through so much water. "Two of our lines," says Mr. Goss, "run over this piece of track, which is our main track, and all cars made their regular schedule time for two days through this water through the rise and fall of the freshet. Through all this and hauling three and four loaded trailers, taking care of last winter's snow, etc., we have had nothing burn out, not even a fuse strip. Our cars are all equipped with General Electric 800 motors and K2 controllers, and are giving us good service." No wonder the electric railway is popular with operating companies and the public when such service is given.

## Telephone Litigation.

It is announced that the Western Electric company of Chicago has brought suit against the Western Telephone Construction company on the Roosevelt patent No. 215,837, claiming infringement.

The officers of the Western Telephone Construction company say that they have received no notice of this suit, although it is supposed to have been begun a week ago. They say, too, that the Roosevelt patent covers an automatic hook and that the Western Telephone Construction company does not use an automatic device in connection with its telephones, and as the hook is worked upon an entirely different principal, it has no fear of the litigation. This patent expires May 27, 1896, having about six months yet to run, and the Western Telephone Construction company says that it is in a position to defend itself against such suits in every respect, and it has no fear of the outcome.

## Revision of Underwriters' Rules.

A meeting of the electrical committee of the Underwriters' National Electrical association will be held at New York on December 10th to consider the revision of rules covering electrical installations. A circular letter and blank have been prepared by the committee and copies have been printed for circulation in order that the matter may be brought to the attention of those interested in the subject, though not members of the organization. Suggestions are desired by the committee, and the secretary of the association, C. M. Goddard, will furnish any additional information desired. His address is 55 Kilby street, Boston, and he is anxious to have electrical men communicate with him on this subject.

## Underground Conduit Railway on Ninth Street, Washington.

An elaborate description of an underground conduit railway is furnished by a Washington correspondent who says that a "road has been in operation two months and is working satisfactorily in all respects," on Ninth street in that city, employing an underground conduit system. The equipment is similar to that employed in the Lenox avenue line, New York, it is said, and it is furnished by the General Electric company. The Metropolitan Railroad company which operates the line at Washington has had some experience with experimental roads before. On this point the correspondent contributes the following:

In 1889 Congress passed a law compelling the Metropolitan road, also the Washington and Georgetown company, to change their motive power from horses to mechanical traction. The use of the trolley was expressly forbidden. The Washington and Georgetown company installed the cable system. The Metropolitan road put in an elaborate and expensive storage battery plant. It equipped the road with a complete and costly power station, and felt certain of success. Practical experience soon developed the fact that the enterprise was an utter failure, and thousands of dollars were sunk in the undertaking. In the act referred to Congress inserted a clause repealing the charter rights of the company in case it did not comply with the direction to install a rapid transit system within two years. As the first attempt was a failure, the road's charter was practically forfeited. Subsequently, however, Congress passed a new law, which provided that an underground electric system should be put into operation. No option was left the company except as to mechanical details. The Metropolitan company secured the services of Albert N. Connett as engineer. He was familiar with the design of the Budapest system, but regarded it as defective in certain respects. In this city, on U street, less than a mile long, is an underground electric road, but Mr. Connett was of the opinion that it was also unsatisfactory in some details. He therefore decided to go ahead on an independent basis, and the road now in operation, with several distinctive novelties in the way of electrical appliances, is the result of his careful and intelligent consideration of the problem he had to deal with. The electrical apparatus was obtained from the General Electric company, the road having obtained from it a guarantee against patent litigation. A number of alternative plans were worked out by Mr. Connett before the one finally adopted was accepted.

SEVERE TEST FOR ELECTRIC RAILWAY EQUIPMENT.

## Trolley Roads in England.

John Bull has at length come to the realization that there are such things as electric roads in the world, and that possibly they may be a good thing, says the New York *Tribune*. An American syndicate has secured the franchise for an electric road in the city of Coventry, which has about 60,000 population, and the work is going ahead.

An experimental road of six miles was put down in the suburbs of the city of Leeds, and the city fathers of various cities and towns have been "junketed" over to Leeds and introduced to the mysteries of the American trolley system. The Coventry authorities were the first to yield to its seductions.

The method of building street railways in England greatly lessens the cost of installation to the promoting capitalist. The city puts down and owns the tracks or permament way. The operating company leases the track for 21 years, and at the expiration of the lease it may be renewed or the city may buy the plant and rolling stock at an appraised valuation.

The Coventry road has eight miles of track, which is all single track, but with long sidings. The estimated cost of rolling stock, poles, wires and power station is $250,000. Everything is to be furnished from America, even to the poles for the wires. It was originally supposed that English poles would do, but when put up they were found unequal to the strain of supporting the wires, and the necessary poles had to be ordered from Philadelphia.

If the innovation takes with the English public there will be a pot of money for the American syndicate, which will probably be called upon to put in similar roads in nearly all the English cities. The conservatism of the English people on this subject seems to be as pronounced today as it was in the time when Citizen George Francis Train put down his first tramway in Parliament street, London, and was then compelled to take up his rails by the outraged and indignant public.

The continental cities have taken more kindly to the electric railroad system, and in fact the first trolley road in the world was in the streets of Berlin. This road had a trolley riding on a wire at the side of the street, with flexible wire

connection to the car. The upward pressure system with the familiar trolley pole of to-day was a later invention.

A firm of English electricians have recently tackled the conduit electric road problem, and produced something in the nature of a small tunnel and motor therein, with a projection which reaches through the slot and pushes the street-car along.

## Three-phase Railway System at Lowell, Mass.

The company to which falls the honor of first using the three-phase system directly in its railway service is the Lowell & Suburban Railway company. The problem before the company was how best to connect its terminus at Lakeview, a delightful resort on the lake, owned by the company, with the car line leading to Nashua, a good fifteen miles away. The solution was found in the use of the three-phase system. Briefly, the principle of the ins allation is this: The three-phase current generated at Lowell is, at a pressure of 5,500 volts, transmitted part to a point about midway between Nashua and Lowell, and part to a sub-station at Nashua itself. It undergoes at both these points, first a reduction of pressure in static transformers, and then a conversion from the three-phase current in a rotary converter, emerging upon the feeder and trolley lines a direct current of 500 volts.

The three-phase generating plant is located in the power house of the Lowell and Suburban system, on Middlesex street. It consists of three four-pole 120 kilowatt, 900 revolutions, three-phase generators, each of which is constructed to deliver alternating current at one side and direct current at the other.

The direct current is called into action only after the main power plant, consisting of six General Electric M. P., 200 kilowatt, belt driven railway generators, is shut down.

The three-phase generators are compact machines, and are connected by belts to a jack-shaft which runs the entire length of the engine room close to the west wall. This shafting has been arranged to permit of any combination of engines and generators, the combinations being made by means of clutches. The generators are rated at 216 amperes. The three-phase current issues at a pressure of 360 volts and is carried to the switchboard, from which it passes to a bank of transformers, erected on a platform, placed in the cellar of the station and set between two of the engine foundations. These transformers are of the General Electric air blast type. They are cooled by a blast of air driven through them by a rotary blower belted to a one horse-power motor.

From the transformers the three-phase current issues at pressure of 5,500 volts, and is carried over insulated cables to a short distance outside the city limits, where it passes to the ordinary three-phase wires which run along the highway upon the same poles as carry the direct current feeders. The three-phase wires are carried upon heavy wide petticoted glass insulators, set upon the side of the cross-arm nearer the road; while the direct current feeder cables occupy that part of the cross-arm on the other side of the pole.

About six miles from Lowell, and a mile and a half from Lakeview, at a place called Eayr's Mills, upon the banks of the Merrimac river, the first sub-station has been erected. This is a wooden structure divided by a partition into two rooms, the outer or that nearer the line being occupied by the rotary converters and direct current switchboards; the inner containing the bank of reducing transformers, also cooled by air blast, and the three-phase switchboard.

The three phase current is brought into this building from the pole standing nearest the station, over cables, to the transformers just mentioned. In these the pressure is reduced from 5,500 volts down to the original pressure of 360 volts. The current then passes into the outer room to the two rotary converters; it issues therefrom, railway direct current of 500 volts pressure, and is carried to the direct current feeders and trolley wires.

These rotary converters are similar in appearance to the three-phase generators, having at one side collector rings, at which the three-phase current is received, while at the other is a regular commutator from which the direct current is taken.

From the two converters the 500 volt current is carried to the feeders and is fed into the trolley wires, toward Lakeview and Lowell in one direction and toward Nashua in the other, through a regular railway switchboard of panel construction.

The substation at Nashua is identical with that at Eayr's Mills. It contains two rotary converters, feeding part of the current into the main railway line from the Nashua end, and part into the city lines.

The operation of the rotary converters has proved entirely satisfactory. The machines have been subjected to heavy overloads, sometimes running as high as 50 per cent. more than the rated capacity without any detriment. They run as smoothly as sewing machines and no trouble whatever has been experienced since they were first started.

The cars running between Lakeview and Nashua are of special make and hold a place about midway between the steam railroad car and the familiar street car. They are fitted with 16 benches, and are mounted upon two independent trucks. They are equipped each with two General Electric 800 motors, controlled by K2 controllers. The speed attained on the open highway between Lakeview and Nashua reaches as high as 30 miles an hour without difficulty. The traffic between the two last mentioned points is already very large and the line has brought the inhabitants of the two busy New England manufacturing cities almost within speaking distance. It enables also the inhabitants of the little hamlets scattered between to come to either for a moderate fare, which is only 10 cents for the entire distance, or 5 cents from either to Lakeview.

The Western Union Telegraph company will put in three additional copper wires between Minneapolis and Chicago.

## General Track Construction.[1]

By C. Loomis Allen.

The evolution of track construction for electric service from that of horse cars has been very rapid, when considered with the length of time it has taken the steam roads to reach the point of excellency which many of them have attained. In fact, some of our electric roads can show permanent way equaled by but few of the steam roads.

The days of stringer—box girders, three-point or butterfly—light girder and light tee-rail sections have passed away to make place for the deep girder or deep tee-rail sections; the former being used in cities and villages of some size, the latter in country roads and small towns. In the transformation of motive power of a railroad system from horses to electricity or cable, the last department, generally speaking, to receive any outlay or money is the track department; and then only when the car repair bills and track maintenance are so costly as to demand an investigation and its consequential repairs. Many of you who have passed through this experience can remember how heavier rails and stronger joints alone was the prescribed remedy, which, when applied, was found to be only temporary, and poor track the result after a few months of operation. It has been only recently and after very costly experience that any attention has been given by street railroad officials to the matter of foundations, or to the conditions of the sub-grade upon which is placed the ballast, and I am sure that experience will bear me out in my statement that economy in track maintenance begins with the making of firm foundations.

A great many obstacles are encountered in finding firm foundations for electric roads, with which the steam roads do not have to cope. Let me cite a case whi h in cities is very common. A street is about to be paved with permanent pavement, and the street railroad officials having secured the best of track material, propose to lay permanent track. Having decided upon the plans of construction, they enter upon their execution. The first work is the matter of excavation of the material in the street to subgrade. As is generally the case, the sewers, water mains, gas mains, electric conduits of subways have been previously constructed a sufficient length of time to allow the trenches to settle—the popular idea is that one winter will settle trenches—the surface of the street seems firm and fairly solid; excavation progresses to such depth as is desired, and the rolling of the subgrade with a heavy roller to make thoroughly firm has begun. Then appears the conditions of improperly filled trenches, vexing the engineer in charge of construction and making him thoroughly disgusted with the manner in which the construction of underground structures is conducted; and well he has a right to be. With sewers in the center of the street, gas, water and subways on either side, very little of the undisturbed ground can be found. The only remedy is to properly fill all the trenches and make them firm foundation. It is enough to discourage the intentions of any railroad company from constructing permanent way, in the face of just one difficulty the size of this. It makes men feel as if they were at their own expense making good the poor work of municipal authorities, and in some cases this is true.

Back-fi ling of trenches in a general clause is always provided for in the specifications for underground structure. This clause is supposed to cover the treatment of all classes of soil, but in actual practice each type of soil requires a different treatment. I do not propose to discuss the manner or methods of trench filling, but I do suggest that railroad companies co-operate with city officials in placing in specifications for underground structure, clauses pertaining to the proper filling of trenches. Post the bidding contractors on such work that these clauses are for the purpose of properly filling the trench, and to the successful contractor in obtaining such a contract, by all means see that the conditions of this clause are fully carried out. The question of back filling has never been given the amount of attention that should have been given it by engineers; the universal belief being that the concrete foundations of pavements will bridge these settlements. How many poor pavements have we in cities and how many pieces of poor tra k can be seen from this erroneous practice. Some few railroad companies have become so thoroughly discouraged in attempts to obtain firm foundations that they have been to the great expense of placing concrete foundations six inches thick under the ties to support them, thus bridging the various settlements. This method may be practical in some cases where firm foundations are not obtainable, but beyond these extreme cases, its cost removes it beyond practical use. I maintain that trenches can be properly filled and by the aid of sufficient rolling, a firm subgrade can be obtained, permitting the use of broken stone ballast and lessening the cost of concrete foundations by two-thirds. Remove all soft and spongy places in the subgrade, lay tile drains connected to sewers to such points as seem at all springy, and have the line of the subgrade, after it has been thoroughly rolled, conform in line and section to the finished grade. You may then feel that you have at least striven to obtain solid foundation. Upon the subgrade should be spread the ballast, and no better quality of ballast can be obtained than stones that have been broken in a crusher to a size that will pass through a two-inch ring. There should be not less than eight inches of broken stone ballast under the ties after the track has been surfaced and tamped. The broken stones should be evenly spread in the trench to such a depth that, having been thoroughly rolled, will be not less than six inches. The rolling should be done by a steam roller weighing not less than 10 tons, and should be continued until the mass of stone shall become thoroughly compact. Upon the broken stone then place the ties. The use of metal ties is bound to come, and with them the exit of the use of wooden ties, but as long as southern ties of standard size of the variety known as the long-leafed yellow pine can be delivered on the cars or wharves of any of our large cities for 50 cents each, the day for the use of steel ties is deferred. I believe thoroughly in the use of metal ties, and that they are the most economical remains only to be proven by the experience gained from their use. We will watch with great interest the results deduced by the experience of the New York Central railroad. As a practical experiment a short piece of track was constructed by that road on the Hudson River division near Garrison station in 1889, using the type of metal tie known as the "Hartford." The results so far have been very satisfactory and the cost of maintenance reduced to a minimum. The use of wooden ties, however, is bound to be common at the present prices for first-class ties, and at these prices no one need buy poor or cheap ties. In drawing specifications for ties do not place clauses in them which experience has taught you it is impossible to fulfill. Specify the kind or quality you know can be bought in the market and make the size not smaller than the standard size, i. e., eight feet long, six inches deep and eight inches wide, and by all means see that the ties you buy are the same as the specifications call for. Do not place less than 120 lineal inches of ties in width to a rail length of 30 feet.

The rails to be used in streets of cities should weigh not less than 85 pounds to the yard, to a section seven inches deep, and if the section you purchase is nine inches in depth, it should weigh not less than 95 pounds to the yard. Select a section with a good wide base not less than 5¾ inches and have the width of the head not less than 2½ inches. Almost any standard section of the nine-inch rail offered by rolling mills is good. There are differences of opinion as to the quality of the finish of the different sections of rail. Some maintain that the girder rail with the tram or "L" head is better finished and more easily kept open to traffic, than the half grooved girder sections. I can speak from experience that the half grooved girder sections we have received from the Johnson company are better finished and make smoother riding track, but we have not yet had the opportunity to try them during a winter, to see if we can successfully maintain traffic; however, we can name the city of Buffalo, with its magnificent railroad system, as an example of successful operation for many winters.

The fish plates or channel bars should be at least 32 inches in length, and if for the nine-inch rail, should be punched for 12 one-inch bolts. I believe the corrugated plate, manufacturered by the Johnson company, is the b st type yet presented, but with any channel bar or plate of the length of 32 inches, bolted tight with one inch bolts, and the nuts held in place by nut locks, the joints should not give way sooner than the rail itself. In fact, the question of joints with fish plates of this size properly bolted, is transferred to a question of ties and what supports them.

Use combination brace plates; do not use tie rods. There are several types of combination plates manufactured. The Johnson company makes a single brace plate and tongue; the Mark Railway Equipment company a double brace plate. The use of either of these have many advantages over the tie rods. I would use brace plates on all deep rails, in preference to tie rods, for the following reasons, if no other: Watch your track foreman, or if your work is done by contract, your contractor laying track. If you are to use tie rods, when the spiking is being done, see if the gauge bars are used, and I will venture to say that the chances are that the spiking gang do not try the gauge of the track more often than on every other tie, and some of the time they forget to do that. They trust to the tie rod to spread or pull, whichever the case may need, the track to proper gauge. Now watch the spiking gang wherever the brace plates are being used, and you will see quite a different use of the gauge bar. At every single tie, the spikers in order to maintain the gauge of the track must use the gauge rod, for there is nothing to pull or push the rails to gauge after the rails are spiked. As a consequence, you have a track laid with greater care, so far as gauging and spiking are concerned, than you will have with tie rods, and that is very essential to first-class and easy-riding track. Tie rods in a pavement tend to constantly help, by vibration, the disintegration of the pavement, to say nothing of the trouble encountered in paving around them.

In laying tracks in city streets, place the rails on the ties, making the joints alternate, and no matter what the temperature may be, be sure the joints are laid without open spaces between the rail lengths; butt the ends of the rails up tight and, when they are in position, bolt the plates up, driving them home with a hammer. Do not spare the cost of inspection at this point, but be sure that the joint plates are all tight. With properly bolted plates and rail ends tight, you have approached as near a continuous track as is possible without welding the joints, and yet you have given a chance in extreme winter weather for contraction.

In driving the spikes be sure that the gauge bars are tried on every tie. Use 5½ by $9\frac{1}{16}$ spikes, four on every tie. When the rails are thoroughly spiked and bolted, the track is ready for surfacing and tamping. Great care should be taken to properly tamp each tie firmly. Ties tamped with broken stone ballast do not sound as firm as ties tamped with gravel ballast, but broken stone will stay in place, while gravel ballast will wash down. Tamping with broken stone costs more, but firmer track is the result. The track now is ready to receive its final alignment, and with great pains and care see that all irregularities in line are taken out. Unless block stone pavement is to be laid, fill to the top of the ties with broken stone, made thoroughly compact by the use of rammers, and you can rest assured that with a space of nine inches from the top of the ties to the surface of the pavement, in which space can be laid the pavement and its foundation, there will be no objections from the municipal authorities of poor foundations. Once more try the bolts and fish plates to see that all are tight, and then place on the bolts the nut locks, to keep them tight. Your track is now ready for bonding. Use the type of bonds that will give the greatest contact with the rail connected by a single No. 0000 wire. The use of single bonds of a larger size saves labor when compared with the use of double bonding with bonds of a smaller size. After your track has been thoroughly bonded you can now turn the tracks over to the paving company.

The Duluth Street Railway company has adopted a system of transfers by which a clock prints on a slip the time it is issued.

1. Read before the Street Railway Association of the State of New York, Albany, September 17, 1895.

## Economical Equipment and Operation of Power House.[1]

By H. S. Newton.

A modern electric street railway station to deserve the name in these advanced days, should embrace in the details of its construction those features which experience has shown to be best adapted to the service required. These details, I take it, are such as would be included by all engineers in a compound condensing station. A preference has been shown by some engineers for certain additional features, by others for features differing considerably in the means toward the end. It is not my intention to enter into a discussion of the relative merits of different apparatus, or the wisdom of different methods, but I shall confine my remarks to the ways and means which we have considered and have adopted in our power house lately constructed at Syracuse.

The Syracuse Street Railroad company's plant is made up of three double compound engines of the upright marine type, having cylinder dimensions 16½ by 31 inches, with a 24 inch stroke. These are belted directly to multipolar generators of 300 kilowatt capacity and exhaust each into an independent surface condenser. The condensed steam from the condensers is pumped through an oil filter or separator into a hot well from which the boiler feed pumps convey it through a pipe heater to the boilers. By this arrangement, not to exceed 10 per cent. of the boiler feed water is taken from the outside water supply, and all difficulty with scale is practically overcome.

The boiler house contains five 90 inch tubular boilers, 16 feet long, each made up of 118 four-inch tubes. These are fed by a pair of pumps, one acting as a relay to the other. The whole plant has been in operation only a few months, and it has been impossible as yet for us to make an accurate test as to its economy. Our coal and water bills have demonstrated the fact, however, that we are making power at a low rate, and this with the additional fact that we are having an entire absence of trouble are all that I can urge as an excuse for this paper.

The feed water is introduced into our boilers through a line of 2½ inch piping connected to duplicate pumps through a pipe heater. We have found two objections to hold against the arrangement as adopted, the correcting of which, I feel, will influence somewhat the economy of the station.

The first of these is the fact that in covering the live steam pipes it was not deemed necessary to cover those carrying the warm water to the boilers. This leads to a difference of some five or 10 degrees in the temperature of the water when leaving the heater and when entering the boiler, and is, consequently, a source of some little loss.

The second point is the absence (since remedied) from the feed-water line of a check valve beyond the pumps to relieve the check valves at the boilers. This would seem to be of small importance, if not absolutely unnecessary, but we have found it of decided advantage in prolonging the life of the valves and doing away with the rattle occasioned in these valves by the pulsations of the pumps. An air chamber over the pumps is also of prime importance in lending elasticity to the system.

In this connection I wish to call your attention to the importance of an injector on each of the boilers. There seems to be a growing tendency to rely entirely on a relay of pumps, thus allowing the operation of the station to hinge on the efficiency of a piece of apparatus which my experience goes to show has a decided tendency to get out of order.

Concerning the economy of using over and over again for boiler feed the condensed steam from the engine exhausts, a great deal may be said. The surface condenser, the necessary adjunct to this practice, is not a particularly rare piece of apparatus, but I find that a surface condenser which is called upon to perform this function is decidedly uncommon in street railway practice. In numerous stations it is used to obtain a vacuum, but in very few is the water of condensation utilized. The character of the water around Syracuse made it very desirable that we should utilize the condensed steam if possible, and after what promised to be some very disastrous experience, we have at last succeeded and are running very successfully, as mentioned before, with over 90 per cent. of our feed from this source.

One immediate result on starting this practice was oil in the boilers, or a mixture of oil and dark brown sediment, which caked over the bottom seams. We removed this and tried again, concluding that it might be shop grease and dirt. Again we had the same result. Examination of the oil filter showed nothing out of order, and consultation with the engine builders evolved nothing new. After endless experimenting, resulting in a leaky boiler or two, and the consumption of a vast amount of chemicals, we have located and remedied the trouble to our entire satisfaction.

The accumulation noticed seems to have been the result of three causes:

(1) The use of too much cylinder oil.

(2) The use of the wrong kind of cylinder oil.

(3) Insufficient filtration of the oil from the feed water before going to the boiler.

The first of these causes was, of course, soon remedied, and the old-fashioned notions of our engineers were shocked with the order to use only three drops a minute for each engine.

The second cause we were longer in discovering the remedy for. Various expedients were tried for cutting up the grease in the boilers, such as carbonate of soda, soda ash, tri-sodium phosphate and lastly kerosene oil. None of these expedients proved effective, however, and it was not until we changed our cylinder oil that we solved the problem. We purchased some oil of purely mineral stock, which has worked so well as to lead me to conclude that it must have been the animal fat in the other oil which was doing the mischief. We are using this oil to-day with remarkably good results, never more than a slight film being apparent in the boilers at the time of the weekly cleaning, and this readily succumbing to the action of a half pail full of soda ash pumped in with the feed water before cooling off.

The third cause of trouble we have recently largely overcome by introducing a number of partitions in our oil filter, by means of which the water is caused to flow alternately over the top of one and under the next, in this way allowing the oil to settle, from its water emulsion, and be collected in the excelsior filling.

The factor that after all has seemed to be the strongest in the solution of our problem in economy is the choice of fuel. We have done quite a good deal of experimenting in this line with various grades of coal and the results obtained have been such as to lead me to very strong conclusions.

The best coal, and by that I mean the cheapest fuel, we have found to be anthracite buckwheat, costing on board cars at our station $2.25 a gross ton. The dust anthracite I find will sift through the bars. When mixed with an equal amount of soft coal, it works very well, but necessitates the help of an extra man as mixer and is not so economically fired. We use 13 tons of buckwheat a day, where it was necessary to use 17 or 18 of the mixture.

A great deal has been written and a great deal more said about the efficiency of special devices, such as high and low water alarms, automatic damper regulators, etc., in the boiler house. Our experience with them has been most satisfactory. We have found that the less responsibility you place on the man who shovels in your coal the better off you are in the end; or, in other words, that as compared with human brains, the mechanical device is at a big premium. By making the engineer responsible for the operation of the devices and keeping them in repair, you are insuring yourself a great deal better boiler-house economy than you could otherwise expect to obtain.

The vertical marine type of engine has given us thus far very good service. The most serious objection that we can urge to them is that they are noisy. In order that the vertical cross-head guides may not be subjected to too serious wear, we have found it necessary to lower the compression below the point usually employed. The natural consequence is more wear in the cross-head crank bearings and more noise. With more compression we get hot cross-heads and guides, and we consider that we have chosen the lesser of the two evils.

Our engines are provided with piston valves for the high pressure, and grid-iron slide valves for the low pressure cylinders. They will govern to within 3 per cent., or about as well as the Corliss.

I don't think the true importance of good engine government is recognized by street railway men. One is apt to regard a badly governing engine merely as an inconvenience resulting in slower speed on the cars and dim lights. The additional loss of power on the line, viz., in the feed wires, trolley wires and rail return resulting from the decreased voltage at the station, is often entirely lost sight of. A few figures on this point might be interesting.

Given a station with generators compounded for a constant potential of 500 volts, with a constant speed on the engines, and a system of feeders allowing for an average loss on the line of 10 per cent. with full load on the machines, with our engines governing perfectly 10 per cent. is lost in transmission. If they slow down as the load comes on so that the dynamos show only 450 volts, with the same watt output, over 12 per cent. of the total energy will be lost in transmission. With 400 volts on the machine over 15 per cent. will be lost Therefore, when we couple with these facts the consideration of loss of light and decreased efficiency of motors at the lower voltage, it is plain that too much importance cannot be given to the government of prime movers.

In conclusion, I cannot refrain from adding one more voice to the cry against cheap labor in the power house. What help of that kind we do employ, and we are not extravagant, I assure you, is used in a subordinate capacity. Our present engineer in charge was employed by me after a very clear demonstration that a cheap man was not capable of handling the plant. A condensing station, with the volume of detail which must be always present in its construction, requires brains for its operation; and the man with brains commands good wages. The pressure that is brought to bear on the management for reduction of wages in the power house is often severe, as I can testify, but the moment the concession is made the trouble begins, and a shutting down for repairs on your road becomes a common occurrence.

1. Read before the Street Railway Association of the State of New York, Albany, September 17, 1895.

# CORRESPONDENCE.

## New York Notes.

New York, October 10.—Whether the present board of rapid transit commissioners make any appreciable progress in giving the city a system of rapid transit, it is true that it has accomplished at least one excellent piece of work, the importance of which is not realized at first glance. Mr. Parsons' report, to which reference was made last week, shows that the corporations whose property rights under the ground would have been interfered with had the city gone straight ahead and done the work of removing the wires and pipes without consultation, now that they have been treated in a conciliatory spirit, have gone very far out of their ways to aid the engineers by furnishing plans and estimates of cost and most of the details of construction, which are made additionally valuable because of the experiences of the corporations themselves. It is for this reason that both the city and these corporations are to be congratulated. The proposed underground railway is a sort of improvement which will benefit all classes of persons, private citizens as well as business men, and the public is coming to look upon the enterprise in this light.

We have been led to believe by the *Sun* that the people of New York would never be satisfied with the underground system proposed by the Rapid Transit Commission and that the elevated roads were constantly growing in public favor. The facts do not bear out the statement, for according to official reports the patronage of the "L" roads fell off more than 8 per cent. during the last year, while surface roads increased their traffic more than 17 per cent. During the year ended June 30, 1895, the elevated railways carried 15,136,547 fewer passengers than during the preceding year, the Metropolitan Traction company increased its traffic by 17,143,993, and the Third avenue railway made an increase of 9,600,000. The two surface railway companies combined carried 178,986,890, while the Manhattan elevated lines carried 187,614,987, a difference of only 8,628,095. The accommodations on the surface lines are far superior to the provisions made on the elevated lines. The lesson of these returns seems to be that the people will discriminate in favor of the company providing the best accommodations and the best service. If an underground system is properly constructed and equipped for first-class service in every respect the people will patronize it.

When the delegates to the Christian Endeavor meeting got through their meeting on Tuesday they enjoyed an excursion over the electric lines of Brooklyn and vicinity. When the decorated trolley cars appeared there was a wild but good natured scramble until every bench was packed to its utmost limit. The route was in Flatbush avenue, past Prospect Park, to Flatbush, thence by Nostrand avenue to Williamsburgh, and back to the starting point. All along the route the excursionists attracted plenty of attention, and after they got to singing, which they did for exercise to get warmed up, for it was decidedly cold, they were followed along the streets by the gaze of listening crowds.

An accident in the plant of the Hudson Electric Light company, Fifteenth and Bloomfield streets, Hoboken, which attracted considerable attention, consisted in the bursting of the flywheel of a 500 horse power Corliss engine. The building was practically wrecked, the damage amounting to about $25,000. The night engineer, Carl Anderson, of 1,127 Park avenue, Hoboken, was instantly killed, and three other employes were injured. These were William Cogswell, electrician, of 1,040 Willow avenue, Hoboken, abrasion on the left arm; Henry Layman, oiler, of 710 Park avenue, Hoboken, sprained ankle; Martin Klein, of 111 Clinton street, Hoboken, injured internally, but not seriously. When the flywheel burst and the engine was wrecked, the large steampipe connected with the boilers was disconnected, and the place was soon filled with escaping steam. All the machinery was rendered useless, the entire city of Hoboken was in darkness and all the cars on the several lines were brought to a standstill.

The pieces of the broken flywheel crashed through the dynamo-room, wrecking the machinery there. One of the pieces tore through the front of the building and landed in the middle of Fourteenth street, a block away. It weighed fully two tons and a half, and had it not struck an iron girder on its way through the dynamo-room it would probably have struck and wrecked several flats in Fourteenth street. Other pieces went through the office, making a large gap in the wall. Three pieces went through the roof, and the wall connecting the engine-room with the boiler-room was wrecked in two places. The engine-room floor was torn up, steel and wooden girders being twisted and broken like pipestems. All day several hundred men worked clearing away the wreckage, and a number of skilled electricians were repairing the damage done to the plant. Power was turned on shortly before 6 o'clock in the evening.

The plant in which the accident occurred is a two-story brick building. It contains all the engines and dynamos which supply the power for all the electric cars running from Hoboken to North Hudson county, and the electric light for that city. It was built and equipped several years ago at a cost of $500,000. The night force consisted of eight men. All were on duty in the engine and dynamo rooms when the accident occurred. The flywheel which burst was attached to an engine which stood in the northwest corner of the building. It was 18 feet in diameter, weighed 50,000 pounds, and was turning at the rate of 225 revolutions a minute when the break occurred. The spokes broke in all directions and were projected through the roof and sides of the building with tremendous force. Anderson, who was standing on a platform above the flywheel, was struck by a piece of the broken machinery, and was thrown high in the air. When his body was found it was resting across an iron girder at the top of the building, seventy feet from the engine floor.

W. F. O.

A resolution will soon be introduced in the St. Paul assembly providing for an inquiry as to the cost of establishing and operating an electric light plant by the city to light the down-town district, and ultimately for lighting all the city now lighted by gas.

## PERSONAL.

G. W. Andrews, general manager of the Dudley Electric Manufacturing company, 81 New street, New York, is in Chicago exploiting the company's individual telephone signal for party lines.

H. D. Stanley formerly connected with the Bridgeport Brass & Copper company and the Okonite company, but now superintendent of the National India Rubber company, Bristol, R. I., has been a visitor at the Metropolitan Electric company's office during the last two weeks.

## ELECTRIC LIGHTING.

An American firm of the City of Mexico has secured the contract for lighting the National Palace by electricity. The government until recently opposed putting in electricity, fearing danger from fire.

## ELECTRIC RAILWAYS.

The committee on streets and alleys, west, has recommended an ordinance to the Chicago City Council allowing the West Chicago Street Railroad company to construct a line on Western avenue, between Milwaukee and Belmont avenues. The joint committee on streets and alleys, west and north, recommended the passage of the Chicago Electric Transit company ordinance providing for an electric line on Irving Park boulevard and Graceland avenue from Milwaukee to Ashland avenue.

The abstract of the record in the case of the Chicago General Railway company against the John Spry Lumber company for the use of the street car tracks of the former in hauling 4,000 loads wood, coal, lumber, etc., upon the same was filed in the Appellate Court last week. The case is carried into the higher courts to test the right to obstruct and damage the trackage of a company operating under the city ordinances. The assignment of errors states that the Superior Court erred in sustaining and overruling demurrers in dismissing the declaration and in rendering judgment for costs.

## TRADE NEWS.

The Missouri Telephone Manufacturing company of St. Louis has been granted a patent upon its special switch.

Portable batteries of chloride accumulators were used in reporting the yacht races from Atlantic Highlands by the Western Union Telegraph company, operating the Edison phonoplex, and from the Highlands of Navesink by the Postal Telegraph-Cable company, operating quadruplex locals.

Colonel John T. Underhill of 136 Liberty street, New York, has taken the agency for the Corliss Engine company of Providence, R. I. He will not be limited as to territory, thus giving an opportunity to his many western friends to again meet him in the electrical trade. The Corliss Engine company will extend the design of this engine to meet the wants of the various lines of business. This concern is again to be prominently identified with the electrical business.

The Sunbeam Incandescent Lamp company, Chicago, has made a new departure in furnishing at a small additional cost ornamental incandescent lamps. This company has recently perfected a process for engraving on its lamps and can furnish lamps engraved with any special design desired, such as photographs, cuts of buildings or flowers. It is already commencing to fill orders, and the demand for ornamental incandescent lamps promises to be a large one.

The Whittingham Electric Car Heating company of Baltimore claims for its type of heater marked efficiency, economy, durability and safety. The heater is composed of wrought-iron pipes running the full length of the car on either side, fitted in suitable castings and attached to the riser of the seat. Each pipe contains a coil of Krupp wire, enclosed within a heat-conducting, insulating tube; the tube and wire are then placed inside the wrought-iron pipe, and both pipe and tube are thoroughly packed by machinery with chemically pure silicia. This construction surrounds the wire with the best possible heat-conducting medium, at the same time perfectly insulating it from the wrought-iron radiating jacket.

The K2 controller of the General Electric company is a modification of the familiar and successful K controller to adapt it to the higher speed motors which are now required for street railway service. The modifications consist chiefly in the introduction of an additional resistance point to secure a smoother acceleration both in the series and in the multiple positions. A cast cylinder has been adopted for the controlling mechanism in place of the original cylinder used with the K, as the newer form presents certain advantages in wearing qualities. The K2 case is very slightly larger than the K, but most of the working parts of the two controllers are identical. Several thousand of the K2 controllers are now in use and their success is but a continuation of the good results reached with the thousands of K's that preceded them.

The Metropolitan Electric company, Chicago, has just added another specialty to its already fine assortment. It has accepted the general western agency for the J. Grant High & Company's, Philadelphia, switches, switchboards and electrical specialties, and engineers and others will save time and confusion by consulting the Metropolitan company. This company can fill orders promptly from a large and complete stock which is always kept well filled. Among the large orders which the Metropolitan company is daily receiving, the demand for "P. & B." insulating compound and "N. I. R." wires and cables is way in the lead. "P. & B." products are so well known to the electrical trade that it is almost unnecessary to mention their excellent qualities. Wherever they have been used the greatest satisfaction has been given. "N. I. R." wires have found a ready market since the Metropolitan company became its western agent. The National India Rubber company announces that arrangements have been made by which a much larger stock will be placed in its Chicago warehouse, which will enable the Metropolitan company to fill its orders with even greater rapidity than heretofore.

## BUSINESS.

The Pumpelly-Sorley Storage Battery company has closed a contract for 80 cells of battery to operate the Rowell-Potter safety stop signal system on the Metropolitan elevated railroad of Chicago.

The Metropolitan Electric company, Chicago, desires to call the attention of the street railway delegates to its new street railway catalogue and discount sheet, which it will pay every interested business man to secure.

F. E. Homer & Co., commutator manufacturers of Cleveland, report the receipt of many large orders for commutators. This would indicate that managers of railways are preparing for the winter, a precaution which all railway companies should take. This firm makes a specialty of repairing old commutators, and refilling the shells, and in this line they are well up in the art. F. E. Homer, the senior member of the firm, was the first man to build a street railway commutator in the city of Cleveland, and as that city was among the first to adopt electricity as a motive power, Mr. Homer's experience can be dated back for at least eight years, showing that he is by no means a novice in the business.

The Heine Safety Boiler company of St. Louis, Mo., enjoys a most extensive brewery trade, as well as a large business among the electrical stations of the West. The company has recently received a somewhat remarkable recommendation from the J. Walker Brewing company of Cincinnati, and mention of the fact will be of interest to buyers of boilers in the electrical trade. The company mentioned paid the Heine Boiler company a bonus for its having exceeded the amount of evaporation guaranteed in its contract with the Brewing company. The Heine Boiler company guaranteed to evaporate 10¼ pounds of water per pound of Pittsburg coal, but the result of the test showed that an evaporation as high as 10¾ had been obtained, which is about 13 per cent above what is considered a good record for water tube boilers, and to express it in the language of the Heine Boiler company, "leaves tubulars out of sight."

The General Electric company will make, as usual, an excellent exhibit of street railway apparatus at the Montreal convention. The headquarters will be at the St. Lawrence Hall and the exhibit will also be made at these headquarters. It will consist of the following apparatus: Two General Electric 800 motors mounted on a Peckham truck to be operated in connection with electric brakes by a B A controller. Behind this will be placed a panel switchboard, consisting of one 3,000 and one 1,000 form K generator panels. One station panel fitted with 5,000 ampere form G; one watt meter for measuring total station output; a 5,000 ampere illuminated dial ammeter; one from A and one from B feeder panels; two section switches, one 4,000 ampere receptacle and one 6,000 ampere receptacle with fuses. The company will also exhibit its motors, consisting of the General Electric 800, the General Electric 1,200 and the General Electric 2,000, in connection with the controllers for operating each. In addition a circuit of arc lamps and a general assortment of overhead and other railway supplies will be shown. The exhibit will be illuminated by electric signs and several interesting pictures will be used. The members present will be as follows: New York offices, W. J. Clark, R. H. Beach, A. K. Baylor, T. Beran, J. McGhie; Schenectady, N. Y.: J. R. Lovejoy, W. B. Potter, H. C. Wirt; Boston office: F. W. Kimball, P. L. Saltonstall, C. C. Pierce, P. Hodges; Philadelphia, Pa.: H. J. Crowley; Chicago, Ill.: T. P. Bailey, F. N. Boyer; Cincinnati: F. H. Strieby; Atlanta: S. W. Trawick; Baltimore: F. C. Todd; Harrison: A. D. Page; Buffalo: T. H. Fearey.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued October 8, 1895.*

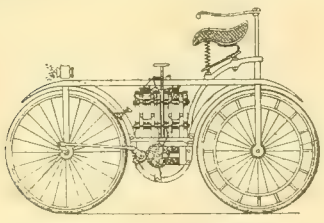
547,441. Electric Bicycle. Hosea W. Libbey, Boston, Mass. Application filed October 9, 1894.

As shown an electric battery and an electric motor are secured to the frame between the wheels, the motor being under the battery and gears; cranks and connecting rods transmit motion to cranks on the axle of the driving wheel.

547,460. Telephone System. Frederic D. Shepard, Milwaukee, Wis. Application filed February 18, 1895.

This system comprises the combination with a single battery of a plurality of stations, each station comprising a transmitting and receiving telephone and a station switch, all electrically connected, each station switch being provided with two contact plates, and a series of binding screws corresponding in number to the number of stations, and a movable double switch arm, the contact points of which are insulated from each other, one point being normally in contact with one of the plates, and the other point normally in contact with one of the binding screws, with wires running from each contact plate of each station switch to the opposite poles of the battery, and with a wire running from the binding screw of each station switch on which its switch arm normally rests to a binding screw on every other station switch in the system.

547,536. Electric Car Lighting Apparatus. William Biddle, Brooklyn, N. Y. Application filed December 24, 1894.

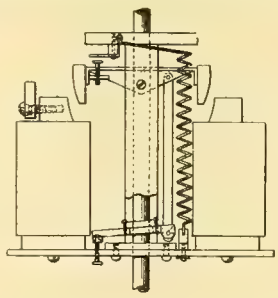


NO. 547,441.

In addition to the dynamo there is a secondary battery. The lamp circuit contains incandescent lamps in multiple arc, and a magnet, the helix of which is in multiple arc in the lamp circuit. A lever is acted upon by the magnet, and connections are made with the cells of the secondary battery for throwing out of the lamp circuit more or less of the cells of the secondary battery, according to the strength of the current therefrom.

547,537. Electric Car Lighting. William Biddle and Harry E. Dey, Brooklyn, N. Y. Application filed January 9, 1895.

A dynamo having two armatures and two sets of field magnets is employed, the helices of one set of field magnets being in circuit with a secondary battery, and the helices of the second set of field magnets being in a circuit from the brushes of the first armature: the brushes of the second armature are in the main circuit to the secondary battery.



NO. 547,659.

547,568. Electric Key Action for Pipe Organs. Edwin S. Votey, William B. Fleming and William D. Wood, Detroit, Mich. Application filed January 21, 1895.

Oscillatory connection plates are pivotally supported at their ends in the organ case, and are provided with electrical conductors, movable key-actuated coupler bars are arranged to make contact with the conductors upon the plates; stops are connected with the plates to bring them into operative position, and a spring to hold the plates normally out of operative position is provided.

547,613. Telephone Switch. Willard M. Miner, Plainfield, N. J. Application filed June 4, 1895.

This switch lever has two positions, a lock for the same when in one position, being operated by the weight of the receiver when in its normal position, the lever when in its other position barring the receiver from its normal position.

547,659. Electric Arc Lamp. Harold E. Bradley, Pawtucket, R. I. Application filed July 1, 1895.

The cut shows an arc lamp containing an electro-magnet, having a secondary adjustable armature, non-magnetic screws for adjusting the same, pins for holding the screws in the armatures, and pole pieces tapped to receive the screws.

547,660. Insulator Pin and Insulator. Charles F. Carroll, Manistee, Mich. Application filed June 6, 1895.

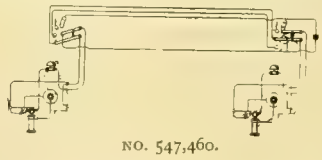
The pin is constructed long enough to pass through the cross-arm of a telegraph or telephone pole, and carries an insulator on the lower end, which also acts as a fastener.

547,714. Time Controlled Electric Heater. Levitt E. Custer, Dayton, O. Application filed December 22, 1894.

The first claim is for the combination with an electro-receptive device or muffle, a rheostat, and mechanism actuated by clock work for throwing the various resistances of the rheostat successively into the circuit.

547,753. Cut-out for Arc Lamps. Daniel Higham, Boston, Mass. Application filed June 27, 1895.

Suitable feeding mechanism having shunt windings is provided, in combination with a carbon rod having a groove, a lever having a pawl to engage with the groove when the carbon rod is fed down and open the circuit of the shunt windings, and a second pawl to engage with the groove when the rod is pushed up by hand to close the circuit of the shunt windings.



NO. 547,460.

547,755. Automatic Telephone System. George K. Hutchins, Baltimore, Md. Application filed May 6, 1893.

The essential features of the arrangement comprise a primary switch, a pilot switch and a station, a single metallic circuit connecting the three, both wires passing through the pilot switch, whereby the movements of the primary switch are controlled from the station through the pilot switch.

Western Electrician.

EVERY SATURDAY.

Vol. XVII. CHICAGO, OCTOBER 26, 1895. No. 17.

## Death of Franklin L. Pope.

Franklin Leonard Pope, patent solicitor, expert and electrical engineer, was instantly killed by electricity on Sunday, October 13th, in the cellar of Wainwright Hall, in the pretty village of Great Barrington, Massachusetts. In accordance with plans prepared several years ago, Mr. Pope had finally decided to make this his permanent home, and there he had gathered those volumes and records which are the jewels of the author and historian. Every possible modern convenience had been considered in connection with the equipment of this model home. Not satisfied, however, with the simple role of a customer of the local electric lighting company, the owner, having been appointed consulting engineer, had planned certain improvements involving an eventual reconstruction of the whole system. This work had already been completed so far as concerned the change from steam to water power, and the new line, about five miles in length, was connected to the old wires in the village and put into operation last spring. It was the intention to gradually replace the old distributing lines as rapidly as the resources of the company would permit. An alternating equipment was selected, and a voltage of 2,100 transformed down to 50 was adopted. In order to facilitate his observations of the working of the plant, Mr. Pope had permitted the installation of a transformer in the cellar of Wainwright Hall, to which the primary circuit was originally led through an underground loop. This had failed twice during thunder storms, and on the last occasion, in the absence of the owner, but with his permission, the wires were brought in overhead, as shown in Fig. 1, which is a view of the north gable of the house. Passing under the cellar window the loop entered, as shown in Fig. 2, which is an interior view of that portion of the compartment in which Mr. Pope met his death, at about half-past five o'clock. The window was obscured, as shown in the picture, by a sheet of paper, in order to obtain better results with a flash-light negative. The converters and meter are shown as they were at the time, but unfortunately the wires had been cut before the arrival of those who undertook an investigation.

Mr. Pope's son, Leonard, was sitting in the south parlor a little past five o'clock on Sunday evening. He is a very intelligent youth of 15, and a close observer. He was reading a book, and as darkness approached he turned on a lamp. A spark jumped from the socket to his knuckle, giving a tingling shock up to the elbow. His father told him not to touch it again, but before the words were spoken he had turned it off. His father then turned on another lamp, carefully touching the rubber key only. He felt no shock, but the lamp was dim. Mr. Pope went out of the room, and the next that was known of him was the heavy fall and the crash of glass caused by the breaking of a lamp chimney. This unusual sound was heard by Anna, the oldest daughter, a bright and thoughtful girl of 19. She thought her brother had fallen, and as soon as she could light a lamp started down stairs, where she saw her father's head on the floor as she approached, and heard the gurgling sound caused by the relaxation of the muscles in cases of this kind. She called to her mother to bring water, and upon her arrival started on a run for Dr. Large, whose office is only about 300 yards away. The doctor responded at once to the call, and promptly undertook the work of resuscitation by artificial respiration, assisted by others then on the spot, and by Drs. Camp and Benjamin, who arrived a few minutes later. There was no hope, however, and the physicians were reluctantly forced to admit that death was instantaneous. There was at one time an impression that a severe bruise on the back of the head might have caused death. In order to remove all doubt, an autopsy was performed on Wednesday by Drs. Large, Small and Lane, which showed that the deceased had been in perfect health, and that the result of the fall in itself would not have been fatal.

HOW THE ACCIDENT PROBABLY OCCURRED.

Ralph W. Pope, secretary of the American Institute of Electrical Engineers and oldest surviving brother of Franklin Leonard Pope, returned to New York on Friday.

Mr. Pope, like his brother, has had a long and varied electrical experience, and, from the time of his arrival at Great Barrington on Monday up to his departure on Thursday, made a daily study of every condition existing at the spot where his brother died. He also carefully questioned every person who had any knowledge of the facts, as no official examination was made beyond the autopsy on Wednesday. Mr. Pope places great confidence in the careful examination of the converters, wires, etc., personally conducted by Edward Weston, William Stanley and George A. Hamilton, than whom, he says, no higher authority could be desired. These gentlemen have a report in preparation which will soon be published.

Franklin Leonard Pope

Mr. Pope's story of the occurrence shows that his brother was apparently the victim of an accident, solely due to the fact that in order to test the lines and observe the working of the plant he had permitted the location in his cellar of a converter, which necessitated the leading in of the primary wires of the system, carrying a normal voltage of 2,100. These wires were brought in at the north cellar window at a point about two feet from the transformer. There was a twisted joint in each wire about midway between the entrance of the primaries and the converter to which they were connected. One of the joints stuck up, and although both were supposed to be covered with so-called insulating tape, it is quite possible that one of the points of these joints was bare, owing to the difficulty of covering such a joint unless extreme care is used. The tape from these joints had been removed after the accident and the wire adjacent to the joints themselves broken on one side and cut with pliers on the other. The joints, Fig. 3, were taken out and were found on the floor behind the cold air box on Thursday. One of the facts which an early examination did not account for was that the main scar on the right hand gave evidence of a mechanical injury, being a deep ragged scratch, as well as a scar from the electrical burn. (See Fig. 4.) The point of either of these joints was well calculated to produce such an injury. Two other minor burns, one on the knuckle and one on the back tip of the forefinger, might have been made either before or after the more serious injury.

As he approached the transformer with the lighted lamp in his left hand to look at the wires, it is possible that he first encountered a strong draft from the open cellar window, the sash of which was suspended by hinges, but according to the statement of Mr. Bell, who was familiar with the cellar, had been unfastened for some time and would therefore swing more or less with the wind. It was necessary in order to secure it, to push the window back and at the same time turn the button on the end of the sash with his right hand. Having thus closed the window, the withdrawal of the hand apparently brought it into contact with one of the twisted joints already described, by which his body was placed in the primary circuit, the current entering his hand, passing through his body and entering the concrete floor through the soles of his shoes. It is quite likely that the flame of the kerosene lamp may have been blown out before Mr. Pope had closed the window, in which case the liability to an accident of this kind was increased, or some other trivial incident may have diverted his attention for a moment. It was a rainy day and he had walked to and from church, a distance of about half a mile, and had also strolled about his yard, so that his shoes were doubtless damp. The wet branches of trees swayed by the wind had also caused grounds on the main line through the village, the consequent flashing having been quite generally noticed that evening. Had he stood closely enough to the window to close and fasten it, he must have stood on a portion of the concrete floor dampened by the dripping of water from the wires, which had no "water-drip" outside.

Mr. Weston is of the opinion that the position of the hand after closing the window was at such an angle with the wire that the existing burn could not have been made by the point, although no other theory as to the raggedness of the injury has been advanced. It is evident that no attempt was made to handle the wires in any manner, all the burns being on the back of the hand.

FUNERAL OF MR. POPE.

The funeral of Mr. Pope was held at the house Wednesday afternoon, October 16th, and was largely attended. The Episcopal service was read by Rev. Dr. Hartley, and a quartette from the choir of St. James church chanted the responses. The commitment service at the grave was also read by Dr. Hartley. The bearers were Edward Manville, Parley A. Russell, Ward Lewis, Merritt I. Wheeler, C. H. Bell and J. P. Pomeroy. The honorary bearers were all electricians and warm personal friends of the deceased. They were Edward Weston, Newark, N. J.; Wm. Stanley, Pittsfield; Stephen D. Field; Stockbridge; James Hamblet, Brooklyn; George A. Hamilton, F. W. Jones, New York. Mr. Pope's brothers, Henry and Ralph Pope, and their families, M. F. Dickinson, Jr., and wife, Boston; Lieut. Walter Dickinson, U. S. A., Amherst; Asa W. Dickinson, Jersey City; Mrs. Lindsay, relatives of Mrs. Pope, were present at the funeral. Among those from out of town were President Whittlesey, of the Stanley Electric company; Mr. Gamwell of Pittsfield, Charles A. Terry, Nelson W. Perry, Robert H. Reid, Joseph Wetzler, Murray Carrington, New York; William Maver, Jr., Jersey City Heights.

BIOGRAPHICAL SKETCH.

Franklin Leonard Pope was identified with the electrical interests of this country since the early days of telegraphy, and he was acquainted with the history of the development of all branches. He has been termed the

historian of the electrical work of this country. The excellent portrait of the deceased which accompanies this article will recall his kindly expression to his numerous friends.

Franklin Leonard Pope was born in Great Barrington, December 2, 1840, in the house at the foot of Mt. Petra, now occupied by James Seymour. A few years after his birth his parents moved to the house in which he died. He was educated in the public schools of the town, and spent one term at the academy in Amherst. In 1848 a telegraph line was built from Bridgeport to Bennington, Vt., which passed through Great Barrington. Even at this early day young Pope evinced interest in its working and in 1857, when a branch of the American Telegraph line was extended to Great Barrington, he was appointed operator. He was taught to operate the Hughes printing telegraph machine. About that time, in connection with two other school friends, he published a small amateur paper called the *Berkshire Rambler*. He remained in charge of the telegraph office for two years, when he was appointed circuit manager of the telegraph line along the Boston & Albany railroad, with headquarters at Springfield. Shortly afterward he went to New York, where he was employed as an artist on the *Scientific American*. During the war the demand for operators brought Mr. Pope back into the telegraph field. While stationed at Providence, during his leisure moments, he made a map of the telegraph service between New York and Boston. This map was seen by the engineer in-chief of the American Telegraph company, General Marshall Lefferts, and he transferred Mr. Pope to New York and subsequently employed him to make a complete series of maps of the company's system, which embraced all the lines of the seaboard states from Maine to Virginia. This work occupied his attention for nearly two years, and during that time he personally inspected the whole system. While engaged in this work the New York draft riots broke out and he was sent to repair the line between New York and Boston. He disguised himself as a farm laborer, and with a portable telegraph instrument and tools for repairing the wires concealed in a sack of oats he left New Rochelle at night and repaired a single wire from that place to the Harlem river before daylight, a distance of 16 miles, and succeeded in restoring communication.

In 1864 Mr. Pope was appointed assistant engineer of the Russo-American Telegraph company. After arriving in San Francisco it was found that a portion of the proposed route had never been explored. Two parties were formed and Mr. Pope was given command of one. In this expedition he was accompanied by his brother Ralph and Stephen D. Field of Stockbridge. In the company of George Blenkinsop of Victoria, B. C., they made the first exploration of the extensive region between the British Columbia border and Alaska, about the Skeena, Stickeen and Yukon rivers. After suffering the privations incidental to an Arctic winter, they finally reached the mouth of the Stickeen river, and found a trading vessel, which took them back to Victoria. They were absent one year. He was next ordered to Kamschatka, but before he could embark for that country the project of constructing a telegraph line from San Francisco to St. Petersburg, by way of Behring's Strait, was rendered useless by the successful laying of the Atlantic cable, and the enterprise was abandoned. On his return to New York Mr. Pope was retained as an expert and engineer in many electrical enterprises. It has been claimed that Edison's first business venture in the electrical world was in partnership with Mr. Pope, under the title of Pope & Edison, and that together they invented in 1870 the "ticker." Other inventions brought him prominently forward in the electrical field. He invented in 1872 the rail circuit for automatically controlling the electric block system now in general use on railways. He also patented many other improvements relating to railway and telegraphic service.

In 1886 he was elected president of the American Institute of Electrical Engineers, succeeding Dr. Norvin Green, and was for many years editor of the *Electrical Engineer*. He wrote "Modern Practice of the Electrical Telegraph" (1871) and "Life and Work of Joseph Henry" (1879). He was one of the first patent solicitors making electrical inventions a specialty, and for several years held the position of patent attorney for the Western Union Telegraph company. Of late years he has had much to do with the Westinghouse litigation, and his work on the development of the incandescent lamp is considered the most comprehensive history of the experiments in that line that has yet been published. The courts did not sustain Mr. Pope's view of the invention of the incandescent lamp, but the most earnest advocate of Mr. Edison's claims must admit that Mr. Pope made a strong case against him. It was as a writer on electrical topics that Mr. Pope was best known. His pleasing style and the earnestness which he displayed carried conviction with his arguments. At the last general meeting of the American Institute of Electrical Engineers he presented a paper on the Great Barrington electric lighting plant, and at that time comment was made in this journal on the excellent character of the article.

FIG. 1. DEATH OF FRANKLIN LEONARD POPE.—NORTH VIEW OF RESIDENCE SHOWING WIRES ENTERING HOUSE.

Mr. Pope was married to Miss Amelia Dickinson at Amherst, 1873. She is a sister of M. F. Dickinson, Jr., a prominent lawyer in Boston, Asa W. Dickinson of Jersey City, formerly a noted lawyer and politician, and Lieut. Walter Dickinson of the United States army, who is military instructor at the Agricultural College in Amherst. Besides a widow, deceased is survived by two daughters and a son. His brother, Ralph W. Pope, is secretary of the American Institute of Electrical Engineers. Another brother, Henry W. Pope, is connected with the American Telephone & Telegraph company of New York.

BROOKLYN ELECTRICAL SOCIETY PAYS A TRIBUTE TO THE LATE INVENTOR.

On October 15th the Brooklyn Electrical society met in the Edison assembly room at Brooklyn and adopted resolutions expressing the grief of the members upon the death of Franklin Leonard Pope, and extending to the family of the deceased assurances of the sympathy of the friends and associates of the late expert. A graceful tribute to his ability and character was also paid by the members.

# THE CONVENTION

## Of the American Street Railway Association at Montreal, October 15, 1895.

The fourteenth annual meeting of the American Street Railway association was held in the Windsor Concert Hall, Montreal, Quebec, October 15-18, 1895. President Hurt of Atlanta, Ga., called the meeting to order at 11:30 A. M. and introduced Mayor J. A. Villeneuve of Montreal, who welcomed the delegates in an appropriate address, in the course of which he said:

Your association, considered in its object and in the result of its labors, is undoubtedly one of the most important of the American continent, and so rapid has been the development of the electrical industry that few have been able to keep trace of its achievements. Its improvement has been a wealth producer; it has cost individuals and communities large sums of money, but this in every case has produced more than the cost, and it has been cheaper to have these improvements than to do without them. This fact cannot be questioned, and the isolated cases of failure in particular experiments, or poorly calculated investments, are but the sacrifices by which the general good has been advanced. I think I may venture the statement that the electrical industry has produced more changes in the American service and convenience of civilized life than has ever been caused by the use of any other method or force subject to the service of man.

There is probably no application of electric power which has attracted closer attention from those whose interest is affected by it than its use for operating street railways, and in no other branch of service has electric power achieved a more brilliant success. I therefore beg to congratulate you, gentlemen, because you are members of an association whose object is to develop, confirm and extend such an important industry, and I pray you to consider yourselves at home in our city—the metropolis of Canada.

President Hurt, in response to the address of welcome, thanked the mayor on behalf of the members of the association, and added:

Such generous words of greeting are to be taken as sufficient license to see and enjoy all that is to be seen in your beautiful city. This association represents one of the great industries of the country. Its members are called upon daily to meet grave and perplexing questions, and probably in that direction it taxes its managers more than any other line of work. Some of these problems will be discussed in our meeting, and we invite you to be present during the deliberations of this body.

Colonel A. A. Stevenson of Montreal was introduced by the president and supplemented the mayor's address. His address was a happy effort and was well received. He said:

We are in the habit of looking upon electric railways as being organized more for their own benefit than the benefit of the public, but that is a fallacy, you know, like many others that obtain credence for a while, but bye and bye the people will learn better. You have fallen into good hands, but even if the citizens do not do their full duty, you will be well cared for by the Montreal Street Railway company, whose officers will no doubt treat you as well as they are treating the citizens at present, and if you are as well pleased with their efforts as the citizens are, I think you will have no ground for regretting that you came to this good city.

This organization was severely handled at a meeting I attended last week at Augusta, Ga.—the International Association of Fire Engineers. It seems that you are a dangerous sort of people after all. In one of the papers read we were told that we would not have any water supply, because electrolysis is to eat away all the pipes, both gas and water pipes, and we will have neither light nor water. That will be a sad state of affairs, I am sure you will admit; but whether it is true or not I do not know. I am sure that if there is any way by which such interference with the gas and water pipes can be averted you will be glad to employ any means necessary.

If there is anything we have not done that you would wish us to do—I mean as citizens—I was introduced as an alderman, which is perhaps not the very best kind of a recommendation—but if there is anything that we, the good aldermen, can do for you, we will be very glad to do it. Mr. Lusher, Mr. Cunningham and the rest of the Montreal gentlemen connected with your organization have not been backward in making their wishes known. To save your modesty, I am sure they will be glad to make such applications as may be necessary, and the application, whatever it may be, is certain not to be unreasonable, because the street railway company's applications heretofore have not been very unreasonable—from their point of view; but whatever they desire to be done for the comfort, convenience and pleasure of the gentlemen assembled at this convention, we will all be very glad to do. I hope you will enjoy yourselves here and go back to your homes with pleasant recollections of your visit.

The next order of business, when the association reassembled after the noon recess, was the presentation of the annual address of the president, from which the following excerpts are made:

You are for the first time assembled in convention beyond the confines of the states, and by this meeting on Canadian soil the lesson is taught that the association is endeavoring to extend and receive the benefits of fraternal intercourse and broad educational work.

There are in operation to-day in the United States about 179,300 miles of steam roads, and about 13,500 miles of street railways. The passenger receipts on the steam roads the past year were $276,031,000. The gross receipts of

street railways in the United States were between $125,000,000 and $140,000,000. The street railway mileage is about 7½ per cent. of the steam railway mileage, and passenger receipts of street railways about 45 per cent. of the passenger receipts of steam roads. The total capitalization, bonds and stocks of steam roads in the United States is about $11,000,000,000, and of the street railways about $1,300,000,000. The latter is about 11 per cent. of the former, while the profits of the steam roads were $322,000,000, and on the street railways about $43,000,000, the latter being about 13½ per cent. of the former. From these figures an idea may be gathered of the magnitude of the business.

There are many questions which call for more extended and complete work. There are new branches of business to be cultivated by the companies, such as the handling of freight and mail, the delivery of small parcels from retail stores through a system of express, the handling of building material to suburban localities, the handling of milk on special cars for the purpose, and the operation of funeral cars from any portion of the system into cemeteries where special facilities are provided.

The companies will need to lend a mutual aid to each other through the national association for the purpose of defeating hostile legislation in national, state and municipal governments, and to conduct a work all along the line which will tend to implant in the minds of the patrons of the roads the fundamental idea that the public interest demands friendly legislation for transportation companies, since this will tend to enable the companies to furnish the best and most rapid transportation, while harmful legislation will tend to bring about the opposite result.

The relation of street railroads to steam roads is growing more interesting, and in some localities even perplexing, until the question is now being asked, What will be the solution of the extension of electric lines, which are cutting so rapidly into the business of the steam roads? A partial consideration of this question brings forth the inquiry, Will not the interests of these two systems of transportation force an amalgamation of the systems, having thereby the main lines connecting distant points, which will be operated into stations at convenient points in municipalities from which passengers will be transported over various street railway lines to their destination?

The steam roads of the country are organized, the territory being subdivided into several sections for the purpose of promoting harmony and mutual protection. While it is true that street railways do not now come into competition with each other, except to a limited extent, yet it is a question if their interests do not demand an organization with sufficient strength and facilities to keep a constant watch over the business throughout the country. It is believed that the time has come when a larger revenue must be raised, either upon the assessment plan or by increasing the membership dues.

The great and important question before you here is the one to enlarge the scope of the association. The executive committee has held three long sessions, two in this city and one in New York, the time being devoted chiefly to a consideration of this question. Seven days and nights have been spent in these meetings, the results of which will appear in the committee's report, to which your attention is invited.

I take this occasion to thank the members of the association, especially those of the executive committee, for the support and co-operation extended to the officers of the association.

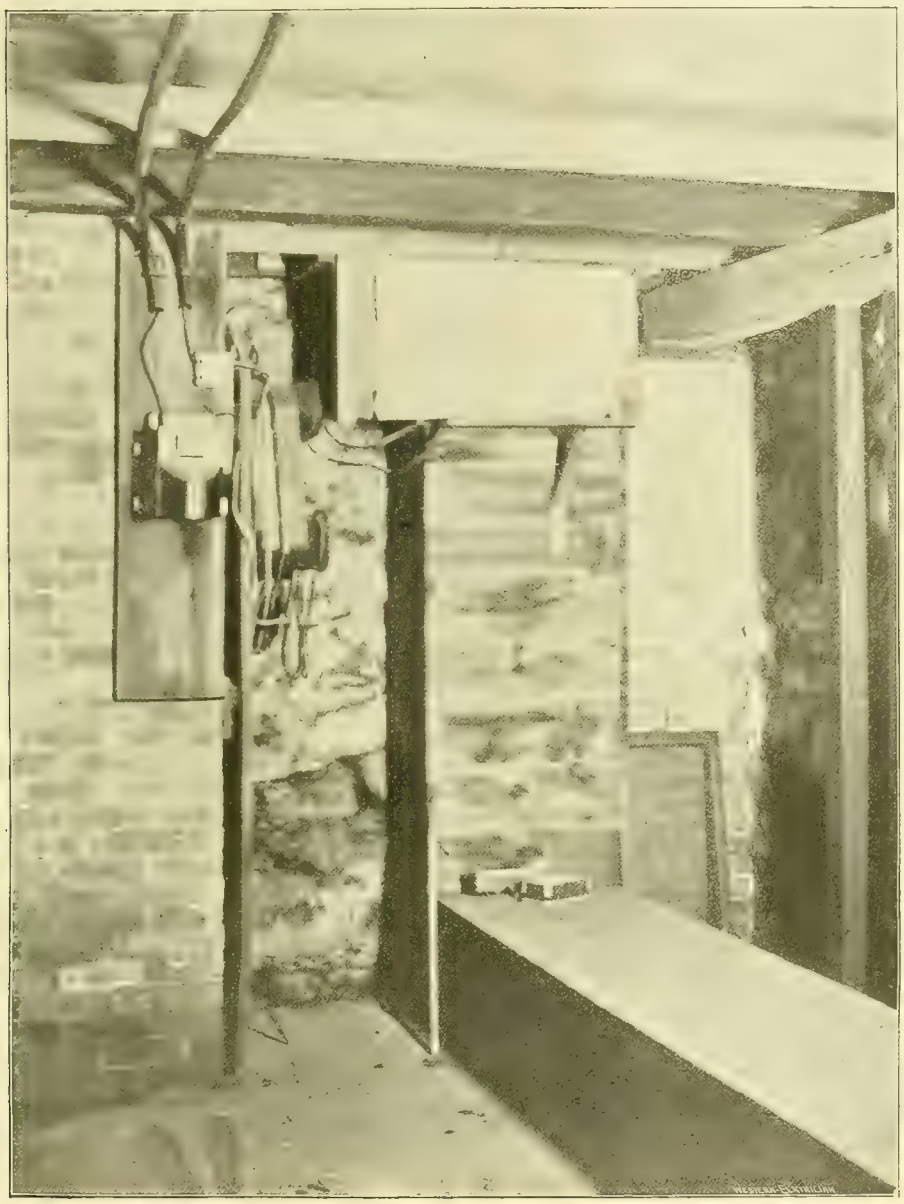


FIG. 2. DEATH OF FRANKLIN LEONARD POPE.—CELLAR SHOWING CONVERTER AND METER NEAR WINDOW.

The report of the treasurer was read and showed the following results: Receipts, $7,554.57; expenses, $7,240.55; leaving a balance on hand of $314.02.

The first paper to be presented was that by E. J. Wessells on "Air Brakes." In the discussion that followed, Mr. Scullin of St. Louis, Mr. Wood of Derby, Mr. Smith of Troy, Mr. McCulloch of St. Louis and Mr. Seely of New York took part. At the conclusion of this business the president announced that E. P. Burch of Minneapolis, who was expected to read a paper on the "Feeder System," through a misunderstanding in not having been advised of the action of the committee in making the selection, was not prepared to make a report on the subject. The time which had been assigned to the consideration of this subject was devoted to a discussion of problems in street paving which were suggested by Mr. Seely of New York. He related the experience of a company in building a railroad in a certain city where the railroad was compelled to pave its strip 18 feet in width with the same material that the city officials paved the remaining portion of the street, which happened in this case to be asphalt. He said:

The paving contractor refused to do the work unless we entirely suspended our service, taking all cars off. The contractor paved one piece and when that was done the railroad company decided it would not give up the street. The paving company has refused to pave that portion of the street, claiming that it could not be done while the cars were in operation, and that the concrete would not set with the cars running over the rails. The railroad company has commenced to put in that concrete itself, keeping the cars moving at the same time. I am pleased to say that it is quite successful so far—the concrete being laid, headers and stretchers being put in, and cars moving right along. Of course it is expensive. The next problem is, who will pave the top of the concrete with asphaltum? The railroad company is thinking seriously of constructing a plant of its own, and I would like to know if any of the gentlemen present have given up the street, given up their entire service, to the paving company while engaged on the street.

Mr. Johnston of Richmond replied: In the work under my charge in Philadelphia I have done a great many miles of street paving, but we do it under contract. In that city they require you to pave the whole street, not your strip; if the street is 100 feet wide, you have got to pave it. Our bills amount to a good many hundred thousands of dollars. In no case have we given up the street to the contractor.

FIG. 3. DEATH OF FRANKLIN L. POPE.—JOINTS FROM THE PRIMARY LOOP.

It is a piece of utter contrariness on the part of any contractor who says that he cannot lay the paving without stopping the cars. We put in a concrete paving in and alongside the rails; we did $600,000 worth of this work. I did the paving in New Orleans, Philadelphia and Richmond. In Richmond we are going to put in a track laid on concrete, and do not propose to stop one minute for anything, as we know it can be done.

Mr. Seely asked: Are you connected with the paving company?

Mr. Johnston replied: No; I am a railroad man. I will say, further, that some years ago I was assistant city engineer in Richmond and had charge of the paving. That was my work, and the contractors did it there for the railroad companies, and the cars never stopped running a minute. There is no reason in the world why they should.

Mr. McCulloch of St. Louis added: We pave between our rails and one foot outside, and between double tracks,

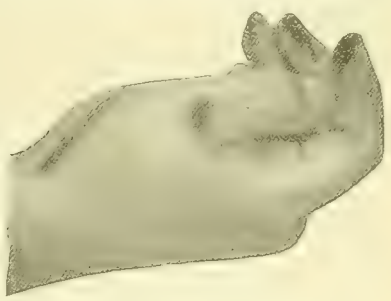


FIG. 4. DEATH OF FRANKLIN L. POPE.—SHOWING BURNS ON HAND.

with the same material with which the street is paved. We are now on one of our roads engaged in just the work the gentleman has referred to. We have two very busy streets, one of them originally paved with asphalt and the other paved with granite, both underlaid with concrete, and the men at this minute are working on both streets, and the asphalt men are paving, the concrete men are paving and the granite men are paving, and our cars are in constant operation, without any hindrance or suggestion of interference. No contractor or paver ever asked us to discontinue the running of the cars. It would not be tolerated by the Board of City Works in our city. It is not necessary, and is unreasonable on the part of the contractor, and in our city would not be tolerated. It is done with the cars in operation, and there never has been any suggestion of anything to the contrary.

### WEDNESDAY'S SESSION.

The convention was called to order by President Hurt at 10:45 A. M., and went into executive session. The first topic on the programme, the "Labor Question," was taken up. The discussion was opened by Mr. Wyman, who was followed by Gen. Jackson.

The discussion was suspended to admit of the reading of a communication from Mr. Baumhoff of St. Louis enclosing a paper on "Transfers." Both letter and paper were read, and on motion the paper was ordered to be spread on

the minutes and printed. The discussion on the subject of "Transfers" was opened by Mr. Sergeant, who was followed by Messrs. Charlton, McCulloch, Jackson and Hurt.

During the session an announcement was received that several gentlemen connected with the Dublin Tramways company were without, having come upon the invitation of the president, and on motion the chair was authorized to invite the gentlemen to occupy seats in the hall and participate in the discussion if they so desired. Seats were provided for them upon the platform.

The discussion of the labor question was then resumed, Messrs. Sergeant, Wyman, McCulloch, McClary, Charlton, Hurt, McLean and Connett taking part, after which adjournment was taken till 2 P. M.

When the convention reassembled a letter was read inviting the members to attend the performance at the French Opera Theater, Thursday evening. Gen. Jackson moved that the association express its appreciation of the courtesy and that the secretary be instructed to acknowledge the receipt of the invitation with the thanks of the association, and that those who desired to attend the performance hand in their names to the secretary. The motion was carried, the chair suggesting that perhaps it might be found practicable to have the invitation apply to Friday evening instead of Thursday evening, so as not to interfere with the banquet.

Mr. Hamilton then read the report of the executive committee, together with the amended constitution proposed by the executive committee. The report was received and a vote of thanks extended to the executive committee and Col. Partridge. An adjournment was taken until 4:30 P. M. to enable the members to attend the reception given by McGill University.

On reassembling at 4:30 P. M. the chair accorded to Mr. Harrison the opportunity of making an explanation respecting his non-concurrence with the report of the majority of the executive committee upon some items embraced in the report. This was followed by a discussion in which Messrs. Harrison, Hamilton, Jackson, McCulloch, Thompson, Hurt, Cunningham, Wyman and Fairchild took part. Finally, on motion of Mr. Wyman, it was agreed that the report as read by the executive committee be spread in full on the minutes, that it be printed and a copy thereof sent to each member of the association, and that action thereon be deferred until the next regular meeting of the association.

The following resolution, proposed by Mr. Littell, was adopted:

That a committee of seven be appointed by the chair to nominate officers for the ensuing associational year, said nominations to include nominations for the executive committee. Further, that said nominating committee shall recommend in the report a place of meeting for the next gathering of this association, and, further, that said committee present its report to the association on Thursday morning next.

Mr. Harrison moved that a committee of 10 be appointed by the chair to devise ways and means for raising the deficit. The motion was carried. Adjournment was then taken until 10 o'clock on Thursday.

AMERICAN STREET RAILWAY ASSOCIATION.—GENERAL VIEW OF EXHIBITS AT VICTORIA RINK, MONTREAL.

### Thursday's Session.

As soon as the convention was called to order in executive session at 10:45 A. M. Thursday, the chair announced the following committees:

On Ways and Means: R. B. Harrison, H. M. Littell, T. H. McLain, W. V. Soper, H. M. Watson, Charles Odell, Charles Green, E. C. Goodrich, T. C. Pennington, John N. Akarman.

On Nominations: C. D. Wyman, Milwaukee; Charles S. Sergeant, Boston; John D. McClary, Birmingham, Ala.; W. J. Thompson, Camden, N. J.; Edward Lusher, Montreal; John A. Seely, New York; Henry Scullin, St. Louis.

Invitations to hold the convention at Saratoga, St. Louis and Chicago were presented, and the numerous claims of the several cities brought before the consideration of the organization. These matters were referred to the committee in charge.

William J. Hammer spoke briefly in support of the request made in his letter for the co-operation of the American Street Railway association with the National Electric Light association in securing the adoption of one standard code of rules for electrical construction and operation, and for the appointment of a representative from the street railway association to serve upon the proposed joint committee. The incoming executive committee was authorized to appoint a delegate on behalf of the street railway association.

A paper by N. L. W. Brown of Atlanta on "Cross Ties and Poles" was received and ordered to be printed. It was not read at the meeting.

The next business was the report of the committee on patents, which was presented by Frank R. Greene of Chicago. The paper was referred to the incoming executive committee.

Mr. Seely offered the following resolution:

WHEREAS, It is the purpose of the National Electric Light association to hold in New York city next spring, at its annual convention, a comprehensive exhibit of modern electrical inventions and applications depending on the use of central station and power house current, with the object of increasing popular interest in electric lighting and allied arts; and,

WHEREAS, It is the desire of the American Street Railway association to promote on the part of the public, particularly in all large cities, a fuller and more intelligent appreciation of the great benefits that accrue from electric light, heat, locomotion, and other modern triumphs of civilization;

*Resolved*, That this association hereby expresses its cordial sympathy with and approval of this plan for the further-

ance of electrical development, and for the enlargement of the sphere within which electricity is to perform its beneficent work.

Mr. Davis: Williamsport said that the exhibition will be held under the auspices of the National Electric Light association, but is to be given in the name of a company formed especially for that purpose, with a sufficient capital to make the exhibit of far more than ordinary interest. The object is to include in that exposition electrical appliances applicable to street railways, as well as appliances applicable to the electric lighting business. The resolution is simply intended to interest the members of this association in that exhibition.

The resolution was adopted, and the meeting adjourned until two o'clock.

The first order of business announced by Vice-president Cunningham when he called the afternoon meeting to order was the report of the committee on ways and means, which was presented by the chairman, Mr. Harrison, and contained the following recommendations:

Your committee recommends that the members of the association be requested to contribute a sum not less than $15 each to liquidate the floating indebtedness of the association amounting, as stated in the report of the executive committee, to the sum of $4,087. Your committee believes that the amount thus realized, together with the net revenue to be derived from the rental of space in the Exhibition Hall, will be sufficient to pay all present indebtedness. And your committee, in order to prevent recurrence of any deficit, further recommends that the practice heretofore established of giving to the members of the association banquet tickets be discontinued, and that hereafter a uniform charge of $5 be made for such tickets. Your committee recommend the adoption by the association of the proposed amendments to Article III. of the constitution and Article VII. of the by-laws, introduced at the Atlanta meeting of the association, which received the unanimous approval of the executive committee and the association itself at the Atlanta, meeting as appears by reference to pages 119, 120 and 121 of the report of the thirteenth annual meeting, which proposed amendments are as follows:

Article III. of the constitution shall be amended so as to read as follows:

Section 1. There shall be two classes of members—active and associate.

Section 2. Active members shall be American street railway companies or lessees, or individual owners of street railways, and each member shall be entitled to one vote by a delegate presenting credentials.

Section 3. Associate members shall be individuals or firms, or companies not embraced in section 2, who have been recommended by an active member. Associate members shall not be entitled to vote.

Article VII. of the by-laws relating to meetings shall be amended by the substitution of the word "Tuesday" for "Wednesday," and by the addition of the following words to the first sentence, namely, "and shall continue four days."

This report was signed by Russell B. Harrison, H. M. Littell, John N. Akarman, H. M. Watson, E. S. Goodrich, Thos. H. McLean, T. C. Pennington and Charles Green.

Mr. Harrison stated further that voluntary subscriptions had been canvassed, and in the space of an hour and a half nearly $2,000 had been subscribed.

There was a long discussion on this report, and after it had once been received other plans were proposed and finally it was determined to raise the necessary amount on the spot if possible. The meeting was canvassed, with the result that $4,475 was pledged by the companies represented, and the secretary was instructed to give every company on the list of members an opportunity to make an additional subscription.

The nominating committee presented its report, which was eventually approved, recommending the following gentlemen to fill the respective positions assigned them during the coming year:

President—H. M. Littell, Brooklyn, N. Y.
First vice-president—Granville C. Cunningham, Montreal.
Second vice-president—William H. Jackson, Nashville, Tenn.
Third vice-president—J. Willard Morgan, Camden, N. J.
Secretary and treasurer—T. C. Pennington, Chicago, Ill.
Executive committee—Joel Hurt, Atlanta, Ga.; Prentiss Cummings, Boston, Mass.; C. G. Goodrich, St. Paul, Minn.; A. Markel, Hazleton, Pa.; W. F. Kelly, Columbus, O.
Place of next annual meeting, St. Louis, Mo.

A vote of thanks to the president, vice-president and the members of the executive committee for the able manner in which they discharged their official duties was unanimously adopted.

Mr. Hamilton moved that the thanks of the convention be extended to E. E. Higgins, who had so efficiently acted as secretary during the convention. Mr. Hurt, in seconding the motion, said: "The executive committee found itself in a position not to justify the employment of an efficient man to perform the duties of secretary. I saw the situation that things were in, owing to the illness of Col. Partridge, and about six weeks ago visited New York and conferred with him, and canvassed a number of names to get some one to do this work. We also visited Mr. Higgins and others. I returned home without having obtained the consent of any party. I wrote and telegraphed Mr. Higgins, and I desire to say that in answer to earnest entreaties he consented to serve the association on the stipulation that there would be no compensation tendered to him." The vote of thanks to Mr. Higgins was unanimously carried.

A committee of three, Messrs. Watson, Hamilton and E. S. Goodrich, was appointed to draft and include in the proceedings of the meeting a suitable resolution of thanks to the citizens of Montreal, who have so hospitably entertained the delegates and visitors.

FRIDAY'S SESSION.

The president called the meeting to order at 11 o'clock, and announced that the regular order of business called for an executive session, but upon the suggestion of Mr. Scullin of St. Louis the session was declared an open one. The president announced the subject of "Furnishing Free Music and other Entertainments by Street Railway Companies to the Public," to be in order. The opinions presented are appended:

H. M. LITTELL.

MR. MCLEAN of Indianapolis: The Citizens' Railway company owns the only park of any size in the city of Indianapolis, which comprises 265 acres, and we find it very profitable during the summer to give entertainments there, particularly in the way of band concerts, and they have attracted many thousands to the park, especially Sunday afternoons and evenings.

MR. MCCLARY of Birmingham: We have a park of about one hundred acres, with a lake 33 acres in size, with pavilion, walks and drives, and every night except Saturday, during the summer, we have a band playing music for dancing. Every Sunday afternoon we have a sacred concert, and find it profitable.

MR. SCULLIN: I would like to ask if it is not a fact, on account of these large crowds congregating at one point, and all being desirous to get away in a short time, there is not a greater liability for accidents, especially in putting on extra cars and allowing green men to handle them? I would like to ask the gentlemen who have spoken on the subject if they have had any such experience?

MR. MCLEAN: So far as our road is concerned, we have been free from accidents at these unusual gatherings. We had the encampment of the state militia in our park this summer, which resulted in a very handsome gain in receipts, and it taxed our facilities to the utmost to carry the people to and from the park during that week, and there was not a single accident.

MR. MCCLARY: We have never had an accident in carrying away these crowds that collect at the park on account of these entertainments. For two years we have had the state militia encampment, and have had as many as 8,000 people at a time in the grounds to bring away at one time, as soon as we could get them away, and have never had an accident.

MR. HURT: As the result of special inquiry on that very point I have gathered the impression that during the time that large crowds gather for pleasure at resorts of this kind everyone is on the qui vive, and there are fewer accidents and less disposition to make complaints to the companies, and if an accident does occur we are less liable to hear from it than on ordinary occasions.

MR. PENNINGTON: I understand in Chicago on "Chicago Day" at the World's Fair we carried 800,000 people, and the most serious accident we had was that someone shoved a man off a car and hurt his arm. The cars were crowded so that we could not make a pick-up from one car to another on account of the fenders rubbing on the ground. It seems at a time like that as if everybody was on the lookout and avoided danger.

J. F. McElroy addressed the meeting on the subject of "Electric Heaters for Street Railway Cars," illustrating his remarks with a number of diagrams.

On motion of Mr. Harrison the meeting passed a vote of thanks for the remarks, and requested Mr. McElroy to revise and amplify them for publication in the proceedings of the meeting, with the diagrams accompanying.

The committee on resolutions presented the following report:

*Resolved*, That the American Street Railway association, in convention assembled, expresses the heartfelt appreciation of its members of the many acts of hospitality and courtesies extended them by the citizens of Montreal, and by the officials of the Montreal Street Railway company, and that we give assurances to both of a grateful remembrance. We came among them as strangers, and found in their homes and hearts a hearty welcome and a love corner—a greeting long to be remembered—and the separation whichnow comes will be long regretted.

To one and all we extend a hearty invitation to our next meeting, where we hope to extend our best welcome.

The resolution was unanimously adopted.

The chair appointed Messrs. Hamilton and Harrison a committee to escort the newly-elected president and secretary to the platform. They were duly installed and acknowledged their election with thanks, and pledged their best efforts in the development of the association.

The meeting then adjourned, to meet in St. Louis the third Tuesday in October, 1896.

## H. M. Littell.

Harvey Mitchell Littell, the newly elected president of the American Street Railway association, is a man of wide experience and national reputation in street railway affairs. He was born in Corydon, Harrison County, Indiana, in 1856. In early life he moved to Louisville, Ky., and attended the public schools in that city. He embarked in the street railway business as a clerk in the office of the Louisville City Railway company about 1874. The president at that time was C. G. Davidson, now of Brooklyn, N. Y., and H. H. Littell, his brother, was superintendent. Young Littell filled various positions, as clerk in the office, starter, time-keeper, track foreman, and almost every position known in street railway practice.

He afterward entered the steam railroad business with the Louisville & Nashville Railroad company. He worked himself up until he reached the position of general freight and passenger agent of what is known now as the Chicago, St. Paul & Kansas City Railroad company. In the interim, however, he filled the position of general manager of the St. Paul City Railway company for nearly three years, from 1883 to 1885, during which time he superintended the reconstruction and extension of the horse railroad system in that city, covering a territory of 30 miles of road.

In 1888 Mr. Littell left the steam railroad business to take charge of the Cincinnati Inclined Plane Railway. The operation of this road was changed from animal to electrical power under his administration in the years 1888 and 1889. He remained here until January, 1893, when he was made president of the New Orleans City & Lake Railroad company and the Crescent City Railroad company, and general manager of the New Orleans Traction company, at New Orleans, La. These lines embraced about 120 miles of horse railroad, the changing of which to electric lines he superintended, completing the work in June, 1895.

On July 1, 1895, Mr. Littell was made the president and general manager of the Atlantic Avenue Railroad company of Brooklyn, which position he now holds. Upon his retirement from the control of the New Orleans roads he was presented by the directors of the company a solid silver dinner service as a testimony of appreciation of his "character and ability as a railroad manager in the development of the property."

Mr. Littell married Miss Prawl of Lexington, Ky., in 1882, and has two sons. He now resides with his family in Brooklyn.

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AMONG the interesting documents issued every week by the Patent Office at Washington, one that will attract more than ordinary attention is the patent granted on October 15th to two Chicago inventors who have perfected an automatic type justifying machine, in the operation of which electricity is employed. This patent is a voluminous document and in it is described the construction and operation of the machine in the most minute detail. The application was made to the patent department on February 14, 1893. In the patent just issued 172 claims are allowed.

IF the Montreal convention did nothing more to commend it to street railway men all over the country, it certainly earned a place of distinction in the history of the organization on account of the action taken there with a view of wiping out the debt that has hampered the workings of the society. But it was successful in other ways. In point of attendance and in the interest shown in the meetings it compared favorably with former gatherings; the exhibition of street railway apparatus was of course a drawing card, and especially as nearly everything shown was of an electrical character. The Canadians, it was particularly noticeable, were very much interested in the apparatus displayed by the representative companies from "the States," Chicago captured the office of secretary, a position which had long been honorably filled by the late William J. Richardson. Mr. Pennington no doubt will prove a worthy successor. He has a great field certainly in which to show his skill in organizing and conducting an association of great financial and industrial interests. He will receive the best wishes and the earnest support of all in this undertaking.

NUMEROUS cases are frequently mentioned in the daily papers in which new points of law as applying to electrical subjects are raised and decided, but there are few who have not made a study of the matter who realize that there has been found a considerable branch of the law devoted to these subjects. As may be expected a collection of the rulings on these cases forms a very imposing as well as important volume, and to many it presents a most interesting study. We have already alluded to the growing interest that is manifested in what may be called electrical litigation, as evidenced by the increasing number of works on this subject. "The Law Relating to Electricity," as explained by S. G. Croswell, includes a valuable treatise upon franchises necessary for electrical lines and the mode of acquiring them, including the important federal grants to telegraph companies, the powers and responsibilities of corporations operating under these privileges, and the authority of the municipal, state and federal governments in the premises. The number, character and extent of the decisions affecting electrical interests are really surprising, considering the short time in which this litigation has been in progress. Truly the aggressive and disputative qualities of those engaged in electrical pursuits are in no other way better shown than by this legal record; the wisdom of this course is not always so apparent.

AFTER all there is little use of paying serious attention to Forbes; we mean George Forbes, the professor who crossed the Atlantic for the purpose of astonishing the American engineers by the "boldness" of his work, the "originality" of his ideas and the "general superiority" of his methods. Evidently these qualities were not recognized or appreciated by the natives of the wilds of Niagara. At any rate, this imported engineer failed to create any commotion, unless it was among his employers, who had to foot the bills and correct his mistakes. It was not until he published his experiences in *Blackwood's Magazine* that American engineers were convinced of the truth of the reports which had preceded Forbes to this country. His former associates did not commend him to their American brethren, and during the course of his work here he was severely criticized and often condemned by English engineers, although many in this country took the position that possibly he was misunderstood or misrepresented. His most bitter enemy could not have made out a more complete case than did Forbes himself in his latest effusion. It fully confirms the first impression, which was very unfavorable, owing to his offensive personality, his insufferable insolence and his exceeding vanity. This is doubtless what he styles his "Englishness" when he says: "An Englishman in America should always try to retain his Englishness; otherwise in a year or two he will be reduced to the level of an average American." It is Forbes' dearest wish always to be looked upon as an Englishman, not necessarily an English gentleman, though, for he has neither the manners nor the address of a gentleman, but rather the boasting, swaggering assurance of a very ignorant and very vulgar person clothed with a little authority. He is not of course accepted in this country as a representative educated Englishman. Far from it; he neither inspires confidence nor commands respect. His egotism is great and his vain pretensions are many. Forbes has come and gone, like many an unpleasant incident, and he has left the impression that he is a very disagreeable fellow. But even now Americans are inclined to look with pity upon him and to regret that he is such an incorrigible fool as to parade his ignorance in public print. His latest production calls to mind Oliver Goldsmith's remark about certain of Forbes' countrymen of his own class: "If mankind should happen to despise them, they are masters of their own admiration, and that they can plentifully bestow upon themselves."

THAT is a peculiarly sad story of the death of Franklin Leonard Pope which is printed on another page of this issue. Such a fatality at any time would be deplorable, but that a man of Mr. Pope's standing in the electrical fraternity, an expert of wide experience and a man who was looked upon as the very personification of prudence should fall the victim under such circumstances is almost incredible. The deceased was of striking personality and kindly disposition. He possessed ability in a marked degree; he had industry and perseverance, too, and while he gained honors among his co-laborers on account of his scientific achievements, he also won the respect of his fellows by his sterling qualities. Most of his life was devoted to electrical pursuits. He grew up with the business and kept apace with it, too. Probably no other man in the country had such a comprehensive knowledge of what had been done in the electrical field as had Frank Pope. His mind was stored with useful information, absorbed, digested and arranged for utilization as the result of many years of study and observation in his chosen profession. It was this great store of information and his ability to turn it to account that made him so valuable as an expert in patent litigation. But it was as a writer upon electrical subjects that he was most widely known. He had a pleasing style, and a happy faculty of presenting statistics and similar information in a way that would hold the attention of the reader. We have had occasion heretofore to refer to this characteristic of Mr. Pope's work and commend his productions to his contemporaries. Only a short time ago, in referring to his paper before the last general meeting of the American Institute of Electrical Engineers, which, by the way, was descriptive of his work on the Great Barrington plant, we commended the manner in which he handled the subject. The Institute, it may be remarked, claimed a considerable share of Mr. Pope's attention. He was president of the organization in its early days, succeeding Dr. Norvin Green in that position, and naturally he took considerable pride in the society which he helped to build. Although of strong convictions and never reluctant to express an honest and candid opinion, Mr. Pope was singularly free from enemies. He was a hard fighter, and valued a victory highly, but it must be won honestly and in honorable contention. A man of his disposition would naturally make many firm friends, and probably the best tribute that could be paid his memory is the fact that he is universally mourned by the electrical fraternity, the men who knew him best.

IT IS announced that a fine bronze statue of Benjamin Franklin will be placed in Lincoln Park, Chicago, the gift of the Hon. Joseph Medill. Accompanying his offer Mr. Medill sends a brief statement to the commissioners explaining his reason for desiring the placing of a suitable memorial of the great American patriot, scientist and statesman in the public park, in which he says: "He is undoubtedly one of the three or four greatest men our country has produced. His name and fame are world-wide. His works will be of everlasting benefit to his countrymen. He reflects luster on the American name. Holding him in this estimation, I have deemed it a personal duty to help keep his memory fresh in the minds of Chicago's youth." This is a graceful tribute to the memory of a man the value of whose work in behalf of his country and in the interest of science is becoming more apparent as years roll by. That he was not fully appreciated in his day is not strange; few great men are, and there are very few whose work has been of such great value as was that of this eminent American. We must remember, too, that in his own country not only was he without an equal, but there were very few who were capable of properly estimating his great ability. In England and in France, the scenes of his most important diplomatic achievements, his reputation was established by actual comparison with the leading men of the two most powerful nations of his time. When it is remembered that his introduction at the court of Louis XVI. was the occasion of much mirth among the gay attendants, and that the very simplicity of his dress was the cause of much ridicule, the disadvantages he labored under at the French court make his subsequent achievements as a diplomatist appear all the more creditable to himself, the cause he advocated and the country he represented. Few men received such honors as were paid to him when his real character was understood. It was fortunate for him and for his country that he was selected for the missions to England and to France, for no one could have better represented the colonies, and nowhere could he have found a better field for his labors. In London and in Paris must be found, if anywhere at that time, men who could rightly measure his ability and accomplishments. Boston, his native town, and Philadelphia, which was his home in later years, were filled with patriotic citizens eager to do service for their country, but they could not understand the magnitude of Dr. Franklin's undertaking, nor the value of his labors abroad. Then, too, there were few men in America in his day who had any idea of the greatness of his work as a scientist. Even at this late day it is only too evident that Franklin's biographers have failed to grasp the situation in this particular, at least those of them who chronicle his achievements for the information of the general public. In works of a purely scientific character due credit is given the eminent electrician for his experimental work in this line at least, and his intelligent observation of electrical phenomena. But it may be said that the scope and quality of his scientific work are not generally understood. As illustrating this point it is only necessary to refer to any of the popular lives of Franklin. Examine, for instance, that in the "American Statesman Series," which is, by the way, one of the most appreciative of these works in other respects, and only occasional allusions will be found to his scientific discoveries and the rank to which he attained in the scientific world. Under the circumstances, then, anything that will awaken an interest in this great American patriot must be welcomed not only by Chicago but by America, and the entire world in fact. We cannot know too much of the character and work of this illustrious philosopher, probably the greatest diplomatist and scientist of his country, and certainly one of the greatest of his age.

## Chicago City Lighting Plant.

At last the Chicago daily newspapers have come to look upon the city lighting project in its true light, and the *Tribune* has published data showing that the department is not present management is in from satisfactory. It should be borne in mind that the *Tribune*, which presents these figures, is an advocate of municipal ownership of such plants. It will be readily understood that the newspaper in question must have found affairs at the city hall in very bad condition indeed to move it to the publication of the article which is herewith appended. A careful perusal of this article will convince any business man that the taxpayers of the city of Chicago are being imposed upon by the city electrician, that his official utterances are misleading and that his report of the cost of producing light is so incomplete and untrustworthy as to convict him of incompetency or dishonesty. He has made statements that have been proven untrue and he has never corrected them, although the inaccuracy has been repeatedly brought to his notice.

Readers of this journal will not be surprised by the publication of this evidence of the city electrician's incompetency. They are familiar with the facts here presented, as the matter was thoroughly investigated by the National Electric Light association, when "Professor" Barrett claimed that he was furnishing electric light to Chicago at the rate of $73 per lamp. Now he admits that it cost $97 per lamp, and one of the ablest friends of municipal lighting places the figure at $150. In all probability the actual cost will figure up more than that this year.

[From the *Chicago Tribune*].

# CITY LIGHT IS DEAR

## Chicago Pays Too Much for Electric Illumination.

## CHEAP IN OTHER TOWNS.

## Reliable Figures Showing the Difference in Cost.

## COMPARISONS ARE STRIKING

### What Has Been Done Toward Providing a Remedy.

### SOME GOOD EXAMPLES TO FOLLOW

According to expert testimony, backed with reliable statistics, Chicago's municipal electric light plants cost the people more a light than those of any city in the country.

This city is the one notable exception to the rule that it pays a municipality to maintain its own electric light plants. Other cities, both large and small, have effected a saving of from 25 to 50 per cent. over the price of street lighting when paid for under the contract system from private corporations.

Taking the official reports from other cities and comparing them with the reports furnished by City Electrician Barrett, the result is anything but gratifying. His figures show that the average cost for each arc light a year is more than $97. This does not include the interest on the money invested and no allowance is made for the sinking fund or taxes. This will bring the total up to something like $150. This is considerably more than the city pays for the lights maintained under the contract system. Several companies have bid under $100 a light for contracts and there is little doubt that the profit would be large at that figure.

For some unaccountable reason the cost of Chicago's street lights has not decreased in the last two or three years, in spite of the fact that all material, machinery, and everything used in the manufacture of light, including labor and coal, have decreased in cost from 10 to 25 per cent.

LIGHT DEAR IN CHICAGO.

There are plenty of towns and cities lighted for less than one-half the cost a light the taxpayers of Chicago pay and there is not a town or city in the United States, as far as can be discovered, with the exception of Chicago, that pays more than $100 a year for its arc lights under the municipal ownership system.

Within the last year a large number of cities have installed or are now engaged in putting in their own electric light plants. Detroit bought out the private corporation which sold it light for years and the city is now engaged in enlarging the plant and extending the service until, within a few weeks, it will have in operation 1,200 arc lights, or nearly 100 more than Chicago, and it is expected that the town will manufacture its own light for less than $100 a light, including the interest on the investment and the allowance for the sinking fund.

Much has been said and written both for and against the municipal ownership of electric light plants, and the figures furnished by Chicago have always been held up as a bad example. Other cities, however, can furnish just as good arguments in favor of the plan. The cost of maintaining the underground system in use in Chicago is undoubtedly greater than that of the overhead system employed in smaller cities, but the difference should scarcely be as great as shown by the comparative figures.

Another thing which makes the cost greater in Chicago is the fact that much of the machinery and apparatus is old and defective.

PRICES FROM OTHER CITIES.

In the investigation of the electric street lighting problem by the city of Springfield, Ill., prior to the purchase of a municipal plant, the following data were received from other cities. The table is compiled from the official reports, from the cities named, sent in answer to inquiry by Springfield officials.

| Name of City | Original cost of plant. | No. lamps. | Yearly cost per lamp. |
|---|---|---|---|
| Bloomington, Ill | $73,000 | 220 | $51 |
| Bay City, Mich | 30,000 | 180 | 46 |
| Jamestown, N. Y | 28,000 | 137 | 44 |
| Aurora, Ill | 41,800 | 162 | 58 |
| Marietta, O | 18,000 | 110 | 60 |
| Elgin, Ill | ..... | 100 | 62 |
| Alexandria, Va | 16,000 | 92 | 55 |
| Ashtabula, O | 25,000 | 120 | 77 |
| Chambersburg, Pa | 20,000 | 72 | 78 |
| Galion, O | 30,000 | 72 | 63 |
| Coldwater, Mich | | 70 | 59 |
| South Norwalk, Conn | 22,300 | 90 | |
| Santa Cruz, Cal | ..... | 74 | 50 |
| West Troy, N. Y | 22,000 | 90 | 00 |

There was no data given to show whether interest had been added to yearly cost, but Bay City, with an investment of $30,000, with 180 lamps burning, 6 per cent. interest would add $10 a lamp to the yearly cost, making a sum total of $56 a lamp a year. Add 7 per cent. a year for a sinking fund and the cost is increased but $11 for each lamp, or a total of $67 a lamp per annum.

In the case of Springfield, Ill., the city has been paying $137 a lamp per annum on moonlight schedule. Sixty citizens offered to assist the city by contributing $1,000 each —$60,000 in all—to build a plant having a capacity of 325 arc lamps. The plant was completed and placed in operation June 1, 1895, and immediately leased to two electrical men, who operate the plant, paying all expenses, for $60 a lamp per annum. The city, however, appropriates at the rate of $113 a lamp; the difference between $60 and $113 becoming a sinking fund to repay the citizens for the first cost of the plant. The city was unable to raise money for the plant, being already beyond the legal bond limit. Thus, the city will own in five years a complete plant for municipal lighting and with a large capacity which can be partially devoted to commercial lighting, providing the present law is changed to enable cities of the state to furnish the inhabitants with light in their dwellings as well as on the streets.

When the old company lost its contract with the city one of its officers secured a temporary injunction from Judge Shirley of the Circuit Court to prevent the city from making further payments to the new company. Judge Shirley rendered his decision yesterday dissolving the injunction and sustaining the new company and the city officials on every point. He held that the carrying out of the agreement made by the City Council was not a misappropriation of the funds of the city, as charged.

COMPARATIVE COST OF ARC LIGHTS.

Here is a comparative table of the cost of street lighting by arc lamps before and after municipal ownership of the plants, as prepared by Prof. Frank Parsons. In every case the municipal service was equal to or better than the contract:

| Name of City. | Under contract system. | Under municipal ownership. |
|---|---|---|
| Bangor, Me | $150 | $48 |
| Lewiston, Me | 182 | 55 |
| Peabody, Mass | 185 | 62 |
| Bay City, Mich | 110 | 58 |
| Huntington, Ind | 145 | 50 |
| Goshen, Ind | 150 | 77 |
| Bloomington, Ill | 111 | 51 |

There is nothing in the data to indicate whether interest was considered in the prices given for municipal cost, but even should he add $20 a lamp for interest and sinking fund the prices for municipal operation would be small as compared to contract system.

The following table gives the cost a lamp in some of the large cities where streets are lighted on the contract system:

| Name of City. | Population in 1890. | Number of lights. | Price per light. |
|---|---|---|---|
| Cincinnati | 296,000 | 1,200 | $ 84 00 |
| St. Louis | 451,000 | 2,000 | 75 00 |
| Cleveland | 261,000 | ..... | 88.60 |
| Louisville | 161,000 | ..... | 84 00 |
| Milwaukee | 204,000 | | 110.00 |
| Boston | 448,000 | | 146.00 |
| Detroit | 205,000 | | 129 00 |
| Baltimore | 434,000 | | 127 75 |
| Indianapolis | 105,000 | 800 | 85.00 |
| Chicago | 1,094,000 | ..... | 137.00 |
| Toledo | 81,000 | | 100.00 |
| Columbus | 88,000 | 850 | 75 00 |

Commenting upon this condition of affairs the *Tribune* says editorially:

Everybody suspected that Chicago was paying too much for its electric lights, but until the *Tribune* showed that many other cities pay less than half as much as Chicago the true state of affairs was undreamed of. Who gets the "rake-off?"

## Members and Visitors.

Following is the official list of members and visitors in attendance at the Montreal convention:

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PRESS REPRESENTATIVES.

Beard, W. C., *The Car*, New York.
Bennett, John B., *Street Railway Journal*, Chicago.
Biggar, E. B., *Canadian Engineer*, Montreal.
Boyd, James, *Street Railway Review*, Chicago.
Caldwell, Edward, *Street Railway Journal*, New York.
Collins, W. Forman, WESTERN ELECTRICIAN, Chicago.
Crossman, T. E., *Stenographer*, New York.
Davis, H. M., *Electric Power*, New York.
De Land, Fred, *Electrical Engineering*, Chicago.
Dickerson, J. W., *Electric Railway Gazette*, New York.
Fairchild, C. B., *Street Railway Journal*, New York.
Greene, B. E., *Electricity*, New York.
Hanchett, Geo. T., *Electric Railway Gazette*, New York.
Higgins, Edward E., *Street Railway Journal*, New York.
Hunt, W. T. *Electrical Age*, New York.
Johnston, W. J., *Electric Railway Gazette*, New York.
Kenfield, H. L., *Street Railway Review*, Chicago.
Kenfield, F. S., *Street Railway Review*, Chicago.
Martin, T. C., *Electrical Engineer*, New York.
Myerson, E. *Stenographer*, New York.
Osborne, W. F., WESTERN ELECTRICIAN, New York.
Partridge, W. E. *Street Railway Journal*, New York.
Poole, Cecil P., *Electric Railway Gazette*, New York.
Price, Charles W., *Electrical Review*, New York.
Ryan, R. W., *Stenographer*, New York.
Shaw, A. C., *Electrical Engineer*, New York.
Simmons, E. A., *Railroad Gazette*, New York.
Tavall, Thos. R., *Electrical Age*, New York.
Taylor, W. H., *Street Railway Journal*, New York.
Taylor, William, *Electric Railway Gazette*, New York.
Tuckerman, H. G., *Electrical Review*, Boston.
Windsor, H. H., *Street Railway Review*, Chicago.
Wood, E. W., *Electrical Industries*, Chicago.

REPRESENTATIVES OF SUPPLY HOUSES.

Ackerman, P. C., American Electrical Works, New York.
Adams, Jr., H. C., Phillips Iron Wire Co.
Allen, W. B., Brownell Car Co., St. Louis.
Allen Rodney D., Smethurst & Allen, Philadelphia.
Allison, Giles G., St. Louis Register Co., St. Louis.
Allyn, Charles B., Brooklyn Supply Co., Brooklyn.
Atkinson, J. W., Forest City Elec. Co., Cleveland.
Atkinson, F. W., Bell Telephone Co., Montreal.
Auchinole, John, E. M. T. Co., Philadelphia.

Bailey, Geo. C., John A. Roebling's Sons Co.
Baker, Jr., C. O., National Electric Light Assn., New York.
Barber, A. G., Valentine & Co., New York.,
Barnard, J. H., Telephone Signal Co., New York.
Barrett, C. E., The Hale & Kilburn Mfg. Co., Philadelphia.
Baumgartner, S., Mass. Car Co., Boston.
Bayliss, R. A., Walker Mfg. Co., Cleveland.
Beadle, Edward, Railway Register Mfg. Co., New York.
Beard, W. W., Lombard Hydraulic Brake.
Bigelow, H. T., Hale & Kilburn Co., Philadelphia.
Billings, William R., Taunton Locomotive Mfg. Co., Taunton
Bonner, W. T., Babcock & Wilcox Co., New York.
Boyd, F. C., New Haven Car Register Co., New Haven.
Bradley, John S., New Haven Car Register Co., New Haven.
Brill, John A., J. G. Brill & Co., Philadelphia.
Brown, R. S., Westinghouse Elec. & Mfg. Co., Pittsburg.
Bruckman, S. E., St. Louis Elec. Eng. Co., St. Louis.
Burns, Charles F., Charles F. Burns & Co., Rochester.
Burnstine, Albert, Berlin Iron Bridge Co., East Berlin, Conn.
Bushe, J. F., Keller Printing Co., New York.

Carter, G. M., Carter Brake Co., Chicago.
Carter, Clarence W., Carter Brake Co., Chicago.
Cass, J. H., Asbestos Mfg. Co.
Childs, Arthur E., Electric Storage Battery Co., Boston.
Christie, W. E., Ottawa Carbon Co., Ottawa.
Chur, Walter, American Ry. Supply Co.
Cicott, Frank X., Pettingill-Andrews Co., New York.
Cisflin, Jr., Geo. D., American Rail Joint & Mfg. Co.
Cleveland, W. B., Forest City Electric Co., Cleveland.
Cockey, M. R., John A. Roebling's Sons Co., New York.
Collins, G. E., Valentine & Co., New York.
Collins, S. O., Stever Rail Joint Co., Cleveland.
Coleman, Charles E., Mica Insulator Co., New York.
Conklin, Franklin, Flood & Conklin Co.
Condit, Jr., S. B., Chase & Co.
Conway, M. W., Contractor, Brooklyn.
Cooke, W. J., McGuire Mfg., Chicago.
Cooke, W. E., Peesham Motor Truck & Wheel Co., New York.
Cooke, H. C., Cooke & Co., New York.
Cosper, W. P., Consolidated Car Heating Co., Albany.
Cragin, H. A., Westinghouse Co., Pittsburg.
Crowley, H. J., General Electric Co., New York.
Curwen, Samuel M., Brill Co., Philadelphia.

Daggett, Jr., H. M., Lombard Hydraulic Brake Co.
Danie's, A. L., H. B. Camp Co.
Darling, George, Darling Brothers.
Dean, W. F., Canadian General Elec. Co., Montreal.
Dean, D. B., Terre Haute Car Mfg. Co., Terre Haute.
De Rende, Frank S., Standard Paint Co., New York.
De Witte, E. F., de Witte Engineering Co., Lansingburgh.
Dick, H. C., Flood & Conklin Co.
Dingman, Mr., Tandem Brake Co., Toronto.
Dittrick, C., Dittrick Brake Co.
Dolph, John C., Forest City Elec. Co., New York.
Donnville, A. E., St. Thomas Car Wheel Co.
Donohue, A. E., American Electrical Works, Chicago.
Downs, William, Fuel Economizer Co., Matteawan.
Doyle, W. L., John A. Roebling's Sons Co., New York.
Dutton, W. A., Dorner & Dutton Mfg. Co., Cleveland.

Edwards, Albert, Edwards Car Fender Co., Brooklyn.
Ellis, S. P. S., The Johnson Co., New York.
Estep, F. A., Nuttall Co.
Estes, S. E., H. W. Johns Mfg. Co., New York.
Evans, H. C., The Johnson Co., New York.
Evans, E. O., The Johnson Co., New York.
Evans, O. C., The Johnson Co., New York.

Feary, Thomas H., General Electric Co., Buffalo.
Fields, Arthur W., Peckham Truck Co., New York.
Flanders, Charles Y., Morris Tasker & Co., Philadelphia.
Fox, Thomas, The Bushnell Co.
Furniss, George, Fire Building & Fibre Brick Co.

Gibson, R. B., Hunter Automatic Fender Co.
Gillespie, H. F., Standard Paint Co., New York.
Glasyone, A. W., J. Morrison Brass Mfg. Co., Toronto.
Godfrey, J. W., India Rubber & Gutta Percha Insulating Co., New York.
Gomer, W. E., Fuel Economizer Co., Matteawan.
Gordon, J. R., Westinghouse Elec. & Mfg. Co.
Gorham, Richard H., Steel Rails, Boston.
Graham, J. H., Graham Equipment Co.
Gray, Louis A., Adams & Westlake Co., Chicago.
Green, Frank J., Bushnell Car Co.
Green, Stanley, Fuel Economizer Co., Matteawan.

Hammer, William J., Consulting Engineer, New York.
Hanna, J. A., McGuire Mfg. Co.
Hansell, Wm. H., Charles Scott Spring Co.
Harding, H. McL., Walker Mfg. Co., Cleveland.
Harrington, F. W., India Rubber & Gutta Percha Insulating Co., New York.
Harrison, H. H., General Inc. Arc Lt. Co., New York.
Hart, J. F., McPherson Sand Box Co.
Haskell, G. M., J. G. Brill Co., Philadelphia.
Hathaway, W. K., American Electrical Works, Providence.
Hatch, E. B., The Johns Pratt Co., Hartford.
Haycox, W. G., Fulton Truck & Foundry Co.
Heinrichs, Ernest H., Westinghouse Electric & Mfg. Co., Pittsburg.
Henry, George W., Cleveland.
Hensler, H., Electrical Engineering Co., St. Louis.
Hewitt, E. A., Bushnell Co.
Hilton, Arthur, Mass. Car Co., Boston.
Hoadley, George M., Bemis Car Box Co.
Hodges, Percy, General Electric Co.
Hogan, John J., Hogan Boiler Co., Middletown, N. Y.
Hogan, William F., Contractor, Brooklyn.
Hogan, W. F., H. W. Johns Mfg. Co., New York.
Hoffman, A. H., Falk Mfg. Co., Milwaukee.
Holt, Pliny E., Carter Brake Co., Chicago.
Hueston, W. S., S. T. Baker & Co., New York.
Huntress, Frank C., Laconia Car Co.
Hurd, G. A., Crane Mfg. Co.
Hurley, Thomas A., Holmes, Booth & Haydens.
Hyde, Lewis C., Wason Car Mfg. Co.

Issertel, Henry G., H. W. Johns Co., New York.

Jackson, E. C., Jackson & Sharpe Co., Wilmington.
James, F. B., Adams & Westlake Co., Chicago.
Johnston, H. C., Charles Scott Spring Co., Philadelphia.

Kaufman, C. C., Street Car Fender.
Kennedy, J. J., Sterling Supply Co.
Kent, Charles W., Walker Mfg. Co., Cleveland.
Keyes, Fred. A., Washburn & Moen Mfg. Co.
King, C. K., Ohio Brass Co., Mansfield.
Kimball, Fred M., General Electric Co., New York.
Kingston, William W., The Johnston Co.
Kirkhouse, B. G., Montreal Electric Co., Montreal.
Kissam, George, Carleton & Kissam, New York.
Knickerbocker, C. K., Griffin Wheel Co.

Lawless, E. J., American Car Co., St. Louis.
Leach, P. F., Brass Foundry & Machine Co., Fort Wayne.
Lewars, George H., Westinghouse Elec. & Mfg. Co.
Lex, F. A., A. Whitney & Sons, Philadelphia.
Leyden, H. R., Royal Elec. Co., Montreal.
Liggett, John C., J. R. Sterling & Co., Detroit-Toledo Car Co.
Lilley, L. G., Underwriters' Assn., Cincinnati.
Littlefield, H. S., The Johnson Co.
Lombard, H., Lombard Hydraulic Brake Co.
Long, E. G., Peckham Motor Truck & Wheel Co., New York.
Loper, A. M., New Haven Car Register Co.
Luscomb, H. H., Johns-Pratt Co.
Luther, H. R., Barbour-Stockwell Co.
Lyons, B. B., Brussells Tapestry Co.

Macdonald, Jr., A. Roy, Mica Dealer
MacDuffie, R. L., Taunton Locomotive Mfg. Co.
Macpherson, Alex., Alpha Rubber Co., Montreal.
Magee, F. A., E. S. Greeley & Co.
Mason, R. W., Mason Electric Equipment Co., Chicago.
Mayer, Charles J., R. D. Nuttall Co.
McDonnell, Alex, Babcock & Wilcox Co.
McElroy, James F., Consolidated Car Heating Co.
McGhie, John, General Electric Co., New York.
McLaren, D. W., L. C. McLaren Belting Co.
McLaren, P. M., Abendroth & Root Mfg. Co.
McPherson, Henry, McPherson Sand Box Co.
McQuaide, Jas. P., National Conduit Mfg. Co.
Mead, Frank S., E. F. Phillips Elec. Works, Montreal
Meaker, J. W., Meaker Register Mfg. Co.
Mellery, H. J., Fiberite Co. Mechanicville.
Meyer, E. D., Heine Safety Boiler Co., St. Louis
Meneely, George R., Meneely Bearing Co.
Mereur, R. J., New York Car Wheel Works, Buffalo.
Milbank, L. A., Holmes, Booth & Haydens.
Miller, J. D., Pierce & Miller Engineering Co., New York
Morris, Elmer P., General Electric Co.

Mason, W. R., Mason Electric Equipment Co.
McCartney, J. L., Ohio Brass Co.
Meikleham, T. W. R., Barnard Elec. Signal & Telephone Co.
Millen, G. S., Sterling Supply & Mfg. Co., New York.
Montgomery, H. M., Goubert Mfg. Co.
Morrell, Frank A., New Haven Fare Register Co.
Morse, C. B., Jacobs Heater Co., Boston.

Nethercut, E. F., Paige Iron Works, Chicago.
Newkirk, H. R., Hoefgen, Moxham & Co., New York.
Noble, E. J., Prout & Noble Co., Chicago.

Paige, Alonzo W., Paige Iron Works, Chicago.
Partridge, Arthur S., Railway Specialties, St. Louis.
Peavey, M. V., Adam Cook's Sons, New York.
Perry, J. W., H. W. Johns Mfg. Co., New York.
Perry, Charles C., Theophile Euphrat, Darien Conn.
Piper, Edward S., Noah L. Piper & Son, Toronto.
Porter, George F., Secretary National Elec. Lt. Assn., New York.
Potter, W. B., General Electric Co., Schenectady.
Powell, G. A., Packard Electric Co.
Pratt, Mason D., Pennsylvania Steel Co., Philadelphia.
Pratt, G. E., Jackson & Sharpe Co.
Price, C. D., Pettingill-Andrews Co.
Pringle, H. E. T., Siemens & Halske Co.
Pugh, D. W., Stephenson Co., New York.
Pugh, John S., Stephenson Co., New York.

Randall, F. C., J. G. Brill Co., Philadelphia
Range, J. W., Consolidated Car Fender Co., Providence.
Ransom, Henry N., Consolidated Car Heating Co., Albany.
Record, E. A., Vacuum Oil Co., Boston.
Reynolds, A. T., Taylor Electric Truck Co., Troy.
Rhotehamel, J. H., Columbia Incandescent Lamp Co., St. Louis.
Richards, H. T., Safety Insulated Wire Co.
Roach, M. C., G. E. P. A., N. Y. C. & H. R. R. R. Co., New York
Robert Louis E., Johnson Company, New York.
Robinson, E. P., Laclede Car Co., St. Louis.
Robinson, John C., Wm. Wharton, Jr., & Co., Philadelphia
Robinson, William, Electric Truck Supply Co., Boston.
Rose, R. M., New York Fare Register Co.
Ross, Edward L., Chapman Valve Mfg. Co.
Rosenthal, George D., General Electric Co., St. Louis
Rugg, E. L., Benedict & Burnham Mfg. Co., New York
Russell, Harry H., E. T. Burrowes Co., Portland.
Russell, F. D., Roches er Car Wheel Works, Rochester.
Rutherford, J. A., Westinghouse Elec. & Mfg. Co., Pittsburg.

Saltonstall, Philip L., General Electric Co.
Sanderson, E. A., Westinghouse Elec. & Mfg. Co.
Scarlett, Sanford G., Scarritt Furniture Co.
Scheffler, Fredk. A., Sterling Co.
Schieren, J., Charles A., Charles A. Schieren & Co., New York.
Schmid, Albert, Westinghouse Elec. & Mfg. Co., Pittsburg
Sclater, William, Keasby & Matheson Co.
Scott, Jr., Charles, Charles Scott Spring Co.
Sharp, Edward P., R. D. Nuttall Co.
Shainwald, J. C., Standard Paint Co., Chicago.
Shepardson, P. A. O., New England Engineering Co.
Sieber, Chas. J., Allentown.
Silver, William S., William S. Silver Co., New York.
Skeed, Robert, Electric Switch & Signal Co., St. Louis.
Slack, W. G., Bell Telephone Co., Montreal.
Speer, J. S., Partridge Carbon Co., Sandusky.
Sperry, Elmer A., Sperry Railway Co., Cleveland.
St. John, William, Safety Car Heating & Lighting Co
Stanley, E. A., Canadian General Electric Co.
Starr, D. A., Dorner & Dutton Co., Cleveland.
Stewart, B. F., Westinghouse Elec. & Mfg. Co
Strieby, F. H., General Electric Co.
Sweet, D. C., Sweet Bronze Sand Box.
Swain, H. S., Hazleton Boiler Co., New York.
Sylvester, John E., Somerville Spike Works Co.

Taylor, John, Taylor Electric Truck Co., Troy.
Taylor, John, U. S. Projectile Co., Brooklyn.
Thayer, Frank A., Goubert Mfg. Co.
Thomson, Fred, Electrical Engineer, Montreal.
Tolles, C. L., Jewell Belting Co.
Trawick, S. W., General Electric Co., Atlanta
Traxler, Charles, Ohio Brass Co., Mansfield.
Trible, Walter P., R. D. Nuttall Co.
Turner, William S., Woodbridge & Turner Co.

Van Dorn, W. S., Fitzgerald & Van Dorn Co.
Vansant, H. C., Morris Tasker & Co., Philadelphia
Vosburgh, A. C., New Process Raw Hide Co., Syracuse.
Vos, William, Barney & Smith Co.

Walter, Franklin, F. Walter & Son
Wardwell, Fred. S., Wardwell Brothers.
Washburne, William A., Cambria Iron Co., Philadelphia.
Watties, James F., Rand-Avery Supply Co., Boston.
Watts, Edward T., Philadelphia Elec. Equipment Co.
Webb, H. E., Solar Carbon & Mfg. Co. Pittsburg.
Weherns, George A., Railway Joint Mfg. Co., New York.
Wendell Jr., Jacob, Taunton Locomotive Mfg. Co., Taunton.
Wessels, E. J., Standard Air Brake Co., New York.
Wheeler, Jr., Albert. Love Electric Traction Co., New York
Whitmore, C. E., Whitmore-Dean Mfg. Co.
Whyte, George S., Badger Mfg. Co. & Chicago Insulated Wire Company.
Wightman, H. J., H. J. Wightman & Co.
Wightman, George H., The Cameyer Steel Co.
Wiley, G. L., Standard Underground Cable Co.
Wilkinson, E. T., Kensington Elec. Co., Philadelphia.
Winters, D. L., Winters Automatic Brake Co.
Wise, Clift, Chicago.
Wood, W. C., Brooklyn, N. Y.
Wood, Chas. N., R. D. Nuttall Co.
Woodbridge, J. Lester, Woodbridge & Turner Engineering Co
Woodward, J. H., Benedict & Burnham Mfg. Co.
Wurster, E. A. Falk Manufacturing Co., Milwaukee.
Wylie, W. W. Ottawa.
Wyman, Edward B., Tandem Brake Co.

Yardley, John H., Philadelphia Car Wheel Co.
Yates, F. A., The Trendley Brake.

## Social Features.

On Wednesday afternoon the delegates, visitors and ladies of the convention were tendered a reception at McGill college, which was participated in by nearly everyone and thoroughly enjoyed. The guests were received by Dean Bovey, Prof. Sanford, Prof. Harrington, Prof. Nicholson, C. Wilson, electrical engineer, and W. Carlyle, mining engineer. Some very interesting hydraulic testing machinery was shown and explained and various experiments performed. The electrical machinery of the college was in operation and work of various kinds was going on in the pattern and machine shops, draughting and other departments, giving some idea of the thoroughness and completeness of the course through which the students are put. A collation was served in one of the upper rooms of the engineering building. The tables were handsomely decorated and provided with all the Canadian dainties.

The banquet was held at the Windsor Hotel on Thursday evening, and was largely attended by the delegates and their ladies. The large dining room of the hotel was deco-

rated with American, Canadian and British flags and the tables tastefully adorned with flowers. The menu was excellent and met with the approval of the guests. The following toasts were given: "The Queen," "The President of the United States," "The City of Montreal," "The American Street Railway Association," "The Retiring President," "The Montreal Street Railway Company," "Our Guests," "The Ladies," "The Technical Press," "The Press," and "Our Next Merry Meeting." These were responded to in fitting style by Joel Hurt, Sir Alexander Lacoste, Consul general Anderson, Mayor Villeneuve, Alderman A. A. Stevenson, Hon. Louis Beaubien, Granville C. Cunningham, Senator Ogilvie, J. H. Stedman, Chas. W. Price, G. Lusher, Col. J. H. Cunningham and others. After a very pleasant evening the fourteenth annual banquet was over.

Among the other entertainments was a special trip over the Montreal street railway and the Montreal & Island Railway company's system and a visit to the power house and shops of the company, which was both instructive and entertaining. A special trip to Ottawa was tendered the members of the association on Saturday by James Ross of the Montreal street railway. The party was conducted over the Ottawa street railway lines and received in the Senate Chamber of the Parliament building, after which luncheon was served at the Russell House, and the special train provided for the occasion took the delegates back to Montreal.

## Special Exhibit of General Electric Company.

The exhibit of the General Electric company was made in one of the stores of the Windsor Hotel, and included the new electric brake. In the center of the large room stood a Peckham truck, equipped with two G E 800 motors and upon each axle was one of the electric brakes. Current was brought to the motors from the lines of the Montreal street railway, and the brake was shown in operation. Street railway men found this of considerable interest to them and readily conceded its effectiveness. Down one side of the room were shown the trio of General Electric motors, the G E 800, the G E 1,200 and the G E 2,000. The other side of the room was occupied by a table upon which was displayed a full line of overhead appliances. Dividing the exhibit from the reception parlor, where delegates found the usual welcome, was a fine example of switchboard work. This consisted of a switchboard built up with General Electric panels for generators and feeders. The extreme left was occupied by one of the large 5,000 ampere generator panels constructed for the West End road of Boston. Above the motors and appliances were hung a set of Thomson arc lamps for railway circuits. The controllers shown were the familiar K2 used in the operation of the Nantasket Beach road, a massive and effective looking piece of apparatus. The minature lamp department of the company was represented by two revolving devices in the windows and a crescent moon hanging from the center of the ceiling over the exhibit, with a little witch, broom and all, sitting in the horn. A large illuminated sign over the doorway told visitors where the General Electric company's representatives could be found, and innumerable incandescent lamps served to light the room and give it an air of warmth and cheerfulness. Much regret was expressed at W. J. Clark's absence, as he has come to be considered necessary for the success of conventions. F. M. Kimball, P. L. Saltonstall, C. C. Pearce, P. Hodges of Boston; W. B. Potter, L. Dunbar Tandy, A. S. Heywood of Schenectady; R. H. Beach, A. K. Baylor, W. G. Bushnell, Elmer P. Morris of New York; H. J. Crowley of Philadelphia; S. W. Trawick of Atlanta; F. H. Strieby of Cincinnati; F. C. Todd of Baltimore; T. H. Fearey of Buffalo; G. D. Rosenthal, St. Louis, represented the factory and the district offices east of the Mississippi.

## Use of Salt and Sand upon Street Railway Tracks.[1]

By D. G. Hamilton and Robert McCulloch.

The use of salt on the rails at certain times and during certain conditions of weather is absolutely necessary in order to clear the rails of a film of ice that will otherwise form on them. Without the use of salt it would be very unsafe to operate cars on a hilly system during winter, and your committee is of opinion that no road can afford to dispense with its use. Salt has been used on street railways throughout the United States constantly while horse cars were in vogue, and now, more than before, is its use imperative in the operation of electric cars.

In like manner sand is a necessity on the rails in order to give the wheel a "proper grip' on the track.

In the city of St. Louis, Mo., the quantity of salt dumped on the tracks is in excess of 3,000 tons in the course of one winter. There is no objection on the part of the local authorities or health board to its use, and but for the use of this salt it would be impossible to operate our cars. The use of sand is also absolutely necessary, and its use is not interfered with in any manner, any more than is the use of salt.

1. Report of committee presented at the convention of the American Street Railway association, Montreal, Que., October, 1895.

## Exhibits and Convention Notes.

The street railway meeting at Montreal was one of the most successful gatherings in the history of the association. In point of numbers it exceeds any former gathering with the exception of the one held at Cleveland. It called together the leading street railway men of Canada, who closely investigated all the apparatus on exhibition and the various supplies for overhead construction, and it will prove a great benefit to the street railway interest of the Dominion of Canada.

Victoria Rink, which was used for the exhibit of apparatus and supplies, is a large building but a short distance from the Windsor Hotel, the headquarters of the convention, and was opened to visitors from 8 A. M. to 10 P. M. each day of the meeting. A band was in attendance evenings and a large number of visitors from Montreal and surrounding country took this opportunity to become familiar with much new apparatus for street railways. The rink was handsomely decorated with flags and bunting, and was specially illuminated for the occasion by the Royal Electric company. A general view of the interior showing the exhibits in position is presented on page 200.

VIEW OF THE GENERAL ELECTRIC COMPANY'S EXHIBIT.

J. A. Roebling's Sons company of Trenton, N. J., was represented by the well-known agents, Doyle & Cockey.

Theophile Euphrat of Darien, Conn., had a new trolley ice cutter which attracted much attention from its peculiar construction.

The Vavasour Mining association of Ottawa, Canada, presented to callers at its headquarters an excellent sample of amber mica.

The Stever rail joint formed an interesting exhibit in malleable iron and cast-steel, especial features of which were explained by obliging attendants.

Morris & MacCurdy of Indianapolis, Ind., had an interesting display of their rubber insulating paint, showing many applications of the same when in practical use.

The many friends of Treasurer C. E. Newton of the Jewell Belting company of Hartford, Conn., expressed regrets that he was not able to attend the convention.

The New York Car Wheel Works of Buffalo, N. Y., had a large exhibit of its productions arranged in a very attractive manner which was closely examined by the visitors.

Marston R. Cockey of New York, the representative of the John A. Roebling's Sons company, as usual made that push for business for which he is well known in the trade.

The Falk Manufacturing company, Milwaukee, Wis., had an exhibition of a cast welded railway joint and other specialties, arranged in a large booth in the exhibition hall.

Secretary G. F. Porter, of the National Electric Light association, was a visitor at the convention and a close attendant upon all meetings. He said he was looking for points.

Edward L. Ross represented the Chapman Valve Manufacturing company of Indian Orchard, Mass., and had a complete line of valves from the midget to the jumbo, and was kept busy in explaining the many good points of this production.

Thomas A. Hurley of New York renewed old acquaintances among the street railway fraternity, and did not forget to look closely after a number of contracts which were reported to be in sight.

The exhibition made of the Empire radial truck by the Taylor Truck company of Troy, N. Y., was most comprehensive, being fitted out with adjustable safeguards and for one or two motors.

The Ohio Brass company of Mansfield, Ohio, had an exhibit arranged in pyramid form of overhead railway material. The company presented to its guests hard rubber match-boxes as souvenirs.

H. M. Montgomery, whose name is synonymous with the best in the mechanical trade, renewed a host of old acquaintances and held a general levee at the headquarters of the Goubert Manufacturing company.

A very brilliant display was made by the Bushnell company of Montreal of railroad signal and cylinder oil, arranged in an expensive booth in the exhibition hall, and contributed much to the general effect.

J. Paul Baker, secretary of the Baltimore Car Wheel company, the selling agent of the Whittingham Electric Car Heating specialties, had a large space taken up in showing this new departure in street car heating.

The Forest City Electric company, Cleveland, O., had a large booth well stocked with the various styles of roll drop commutator bars. It was presided over by the eastern manager, John C. Dolph of New York.

The Kalterbeck street car fender, which is manufactured at Kingston, N. Y., was one of the attractions which interested the street railway motormen, and much time was given by parties in looking up its practical points.

A. Roy MacDonald, Jr., of Montreal, erected a miniature mica mine showing a very interesting display of his products. It was brilliantly lighted by numerous incandescent lights and presented a most attractive appearance.

Albany grease was a lubricant which had the attention of the delegates, and the samples of this well known compound were in great demand, and were given impartially by their general agent, M. V. Peavey of New York.

A most attractive exhibit was that of A. Ray MacDonald, Jr., of Montreal, which comprised samples of Canadian mica in the form of a mica grotto containing 21 different qualities of all kinds of mica for electrical purposes.

The Adams & Westlake company of Chicago presented a very complete display of window shades for both open and closed cars, showing a section of a car equipped with the several styles and making a very attractive exhibit.

W. J. Hammer of New York, the well-known engineer, was in attendance upon the convention, going from Montreal on an extended trip to the West. Mr. Hammer renewed old acquaintances in the street railway business.

H. C. Adams, Jr., New York agent of the Phillips Insulated Wire company, had a confidential "tip" which he presented to the delegates and visitors at the convention, wherein O. K. wire for feeders was strongly emphasized.

The Charles Scott Spring company of Philadelphia was not able to show as complete an exhibit as anticipated, because of the non-arrival of its goods; it, however, had a few samples which did not escape the eye of the visitor.

J. W. Godfrey and F. W. Harrington were in attendance at the convention, representing the interests of the India Rubber & Gutta Percha Manufacturing company of New

York, which concern is now doing some business in the overhead way 1dd.

J. H. McGhie, of the General Electric company of New York, as usual was one of the hardest worked men at Montreal, and covered the necessary ground with his usual skill. He left nothing undone in the way of supplying reading matter to delegates.

The exhibition of fenders in the exhibition hall was closely examined, and the attendants of the Columbia company and Himphy company of Montreal and Consolidated company of Providence, R. I., were kept exceedingly busy explaining their apparatus.

The Weber railway joint was shown. The result of the test made at the Watertown Arsenal, where the joint successfully withstood a pressure of 200,000 pounds, was a point which interested the delegates. The main office of this company is in Wall street, New York.

E. J. Wessels, president of the Standard Air Brake company of New York, who is considered authority upon questions regarding brakes, was continually surrounded by visitors interested in the subject to hear his ideas and get the advantage of his practical knowledge.

The Cutter Electrical & Manufacturing company of Philadelphia had an exhibit of automatic magnetic circuit breakers mounted in such manner that the workings were shown in a comprehensive manner. A number of good orders were taken for immediate shipment.

The Hogan Boiler company of Middletown, N. Y., had a large display of framed photographs and engravings illustrating the features of this well-known boiler, together with numerous parts, showing in detail its construction. The company claims to have a non-scaling boiler.

The Partridge Carbon company, Sandusky, Ohio, was represented by J. S. Speer, secretary of the company, who had a neat little exhibit of the well-known Partridge carbon motor and dynamo brushes, which have achieved a great reputation for their many good qualities everywhere.

Delegates will always find Lewis G. Rowand of the Universal Fire Alarm company of Camden, N. J., at the street railway conventions. He was a close attendant at the sessions at Convention Hall, and nothing seemed to escape his investigation of the new things at the Victoria Rink.

The Fulton Truck & Foundry company of Mansfield, Ohio, had a booth where models of the Imperial truck, both standard and center pivot, hydraulic motor lift and Troy sand box were the leading features, and the merits were closely investigated by the street railway superintendents

W. S. Turner, of Woodbridge & Turner of New York, the well-known street railway electrical engineers and general contracting agents, was a close attendant of all meetings of the association. He stated that he considered the convention one of the best ever held in point of interest.

D. W. Winters of No. 5 Lexington street, Chicago, had a model of his new brake, for which the claim was made that it possessed all of the advantages of other systems, having no valves to get out of order or hose to burst. Much interest was shown in the investigation of this new appliance.

The St. Louis Register company, St. Louis, Mo., was represented by G.S. Allison, who with an attendant showed the fare register in practical operation upon models of open and closed cars. "The security," which is reliable in action and simple in construction, demonstrated the claim to this name.

The Robinson radial electric truck was shown by a model possessing some very important features, being a departure from the trucks in general use. William Robinson, the general manager, was surrounded much of his time by interested gatherings as he pointed out the many advantages of this new system.

The special souvenir issue of the *Street Railway Journal* distributed at the convention contained articles on the street railway systems of Canada, especially those of Montreal and hundreds of illustrations of street railway plants and portraits of street railway men. It was a very creditable publication.

"Are you earning dividends?" was the pertinent question asked in a circular presented by the Graham Equipment company of Boston, and it seldom failed to stop the visitor to examine the number of electric car improvements which were shown by the company upon a full sized car in the exhibition hall.

C. O. Baker, the platinum magnate of Newark, N. J., was in evidence, and, as usual, furnished much information regarding all points to the convention delegates. He only went to Montreal to "look around." From the orders which he received it would indicate he glanced about very successfully.

General Manager E. W. Little, of the Interior Conduit company of New York, was prevented from reaching Montreal until the third day of the convention, but he very quickly made up for lost time by his usual energetic manner of covering the ground quickly in the interests of this well-known concern.

C. E. Siblay of New York had a telephone system in operation which attracted a large crowd. It certainly got the benefit of numerous hard tests, but it stood them all in the efficient manner which was claimed for it, and there were numerous applications for illustrated circulars for future reference.

The Walker Manufacturng company of Cleveland, O., showed a very handsome switchboard for power station, complete with switches and instruments; also two motor trucks, one equipped with 25 horse power motors and the other with 50 horse power. Two armatures, one complete and the other partially wound, showing method adopted, were also exhibited. The company was represented by F. Billings, S. H. Short, H. McL. Harding, W. H. Bone, R. N. Baylis, B. M. Barr.

The following prominent officials of the United Tramway company, Dublin, Ireland, arrived at the hall Wednesday evening: Wm, Carte, president; Wm. Anderson, manager; Wm. M. Murphy and John R. Wigham, president of the Dublin Chamber of Commerce, directors.

M. J. Forget, president of the Montreal Street Railway company, provided a delightful entertainment for the guests of the street railway convention at a fox hunt and breakfast at his country home at Ste. Anne, and a large number accepted on Saturday morning and voted it the social event of the meeting.

The Partridge Carbon company of Sandusky, Ohio, was represented by J. S. Speer, and he presented the merits of the self-lubricating motor brush to the many people who investigated it for street railway and power purposes. Numerous samples were demanded and a large number of trial orders were taken.

The Okonite company, limited, is never anything unless original. Its general manager, Captain W. N. Candee of New York, was kept busy in handing out souvenir samples of Manson tape in attractive metal boxes. This concern does a large business in Canada and needed no introduction in that vicinity.

The Peckham Motor Truck & Wheel company, New York, had a large force at the convention, headed by a President Peckham. Messrs Cook, Field, Wilkinson and Long did not let any person that desired information regarding the company's trucks remain unsatisfied regarding their superior qualities.

On Thursday afternoon the delegates were invited to a ride about the city in special cars furnished by the street railway companies, which were handsomely decorated with flags and bunting, presenting a very gay appearance. A visit was made to the power stations, after which an extended ride was taken about the city.

G. A. Hurd of Chicago represented Crane & Co. with a full line of brass and iron boby valves which have the advantage that they can be repacked without shutting off steam The special catalogue of this concern was eagerly sought after and to such an extent that the supply was entirely run out on the second day of the convention.

The exhibit of the Consolidated Car Heating company of Albany, N. Y., in charge of J. F. McElroy and H. N. Ransom, was one of the popular resorts of the exhibition, and was brilliantly illuminated by incandescent lamps. These gentlemen were kept constantly busy in illustrating the principles of the electric car heating system.

C. E. Coleman, of Eugene Munsell & Co. of New York, had a very attractively arranged exhibit of this concern's manufacture, which was shown, he claimed, upon every place where insulators could be used in connection with street railway work. The very complete pamphlet presented the visitors fully substantiated this statement.

The display of the Skeen Electric Switch & Signal company of St. Louis was of a most interesting character and was shown in practical operation under many conditions which interested the practical street railway superintendents who have been investigating this subject so long. The trolley compact was also a leading feature of the exhibit.

A. N. Loper held the attention of visitors at the booth of the New Haven Car Register company of New Haven, Conn., with a very complete line of apparatus, showing the new shield regulator, which covers the figures of indicators in such a manner that it serves as a detector upon the conductor should he fail to ring up the fare upon the car.

Hugh Harrison of New York represented the interests of R. B. Corey in presenting interesting facts of the General Incandescent Arc Light company's lamps. A large number of this company's lamps, which are in general use, did not need any formal introduction, and Mr. Harrison placed several good orders as a result of his visit to Montreal.

J. H. Woodward, of Benedict & Burnham Manufacturing company, had a booth very tastefully decorated. Upon every hand the company's solid one-piece rail bond was shown and a display made of numerous productions of wire. A long list of roads now using the bonds was the recommendation and a souvenir which the company presented the visitors.

Secretary Charles A. Schieren did not bring any samples or exhibit of the Schieren Belting company of New York. The numerous calls that he had previously made upon the delegates when at home in presenting the claims of this well-known production made them thoroughly familiar with the subject, but his trip was not in vain, as a number of orders attested.

General Manager E. B. Hatch, of the H. W. Johns company's factory of Hartford, Conn., was a prominent visitor at Montreal. His time was devoted chiefly to a close investigation of where the company's material could be used to more advantage by the street railway people, and a number of important new styles will be added to the already large list.

The Sterling Supply & Manufacturing company of New York had a most attractive exhibit which occupied a prominent location in the center of the exhibition hall, being fitted up to represent all such portions of street cars as would use an endless variety of apparatus. Very prominently was noticed the new Sterling fare registers and also a number of new overhead appliances.

The Keller Printing company of New York had a complete line of railroad tickets which were dated at the time of presentation by the company's new dating machine, which showed many important improvements over the system in general use for transfer tickets. Edgar R. Mills, acting secretary, of New York, was kept busy in explaining the many advantages of this system and giving out the new illustrated circular.

The New England delegation, 60 strong, with many ladies, left on the Boston special Saturday noon. The train stopped at Fabyan House in order to allow the passengers to enjoy the White Mountain scenery. Charles S. Clark, secretary of the Massachusetts Street Railway association, was in charge of the delegation.

E. H. Heinrichs, of the Westinghouse Electric & Manufacturing company of Pittsburg, Pa., went to Montreal several days in advance of the meeting to arrange for the proper distribution of the company's very attractive printed matter for the convention, and as usual rare good taste and judgment were shown in the elegant illustrated matter found at the headquarters.

The New York Insulated Wire company of New York was ably represented by General Sales Agent P. H. Hover, who presented the claims of this company in no uncertain way, which resulted, he reports, in a number of orders. The Grimshaw tapes, and splicing compounds are well-known productions of this companywhich merit the high regard of the trade.

P. M. McLaren, the pushing representative of the Abendroth & Root Boiler company of New York, did not let any opportunity escape for presenting the claims of this well-known concern. His large acquaintance among street railway officials made it always easy to get the attention of such gentlemen when desired. The interest of this concern could not have been in better hands.

John A. Seely, of the Complete Electric Construction company of New York, represented this concern at Montreal. The large amount of street railway construction which the company has done makes them well known among the street railway fraternity. Mr. Seely was kept busy in looking up a number of possible contracts which will in some cases be completed this fall and winter.

The complete beauty of the exhibition hall was marred by a somewhat sad incident. One of the exhibitors became so much mixed as early as nine o'clock in the morning as to forget the proper spelling of his name, and as a result the proper spelling was a source of inquiry among his many friends. General sympathy was expressed and prayers offered for his reform before another convention.

The Standard Underground Cable company of Pittsburg, Pa., was represented by G. L. Wiley and James R. Wiley. The feeder cables of this concern were so well known that they did not consider it necessary to have an exhibit. There is probably no better known man in the general trade than G. L. Wiley, who so long has had the care of the interests of this concern in the East, with headquarters at New York city.

H. McL. Harding had charge of the affairs of the Walker Manufacturing company of Cleveland, Ohio, going from New York with the delegation. The exhibit of this company was of the usual high standard, and as it is widely known for the excellence of electrical apparatus for specially large sized generators and street railway motors, much time was given by the visitors at this location in the exhibition hall.

General Manager Frank A. Thayer, of the Goubert company of New York, presented in his usual forcible manner the merits of this well-known feed water heater, which has been so numerously adopted by leading street railway companies. It is a pleasure to hear of the continued growth of this company, and not a little credit can be given Mr. Thayer for its success, as no one is more favorably known to the general trade.

H. T. Richards represented the Safety Insulated Wire & Cable company of New York, and although this was his first appearance for this company at a convention, his large acquaintance among the street railway men made it comparatively easy to speak a good word for the company's productions. Evidently but little of interest in his line escaped his attention, as the same push and energy were shown as have always identified Mr. Richards' career in the electric business.

A. L. Daniels of Akron, O., had a very fine display of standard bushings manufactured by the Akron Insulator & Marble company, and also a full line of porcelain insulators of various designs. Mr. Daniels also had samples of vitrified clay conduit manufactured by the H. B. Camp company of Aultman, Ohio. This conduit has been adopted by a number of companies for telegraph and telephone purposes, and the future promises very bright for a large trade of this material.

Secretary J. P. McQuaid, of the National Conduit company of New York, did not have an exhibit, but the convincing arguments with which he presented the claims of this company's conduit made it unnecessary. He reports that the season now closing will show the largest business this concern has ever done, and has not been confined to any one portion of the country. The duplicate orders for extension of lines have been numerous, and indications are for a still larger season in 1896.

Stanley Green, the popular Chicago representative of the Fuel Economizer company, together with General Manager J. H. Blackburn, left but few delegates that were not informed regarding their excellent apparatus, which has of late been so liberally installed in the leading power stations of the country. The success of this concern has been largely owing to the untiring efforts of these gentlemen in presenting convincing arguments regarding this apparatus and the great merit of the same.

Secretary H. C. Vancent of Morris Tasker & Co. of Philadelphia had headquarters at the Windsor, which were always crowded, and attested to his popularity and the worth of this company. He referred with pride to the productions of this concern as seen on the streets of Montreal, where iron poles for electric railway construction, are used,

and also many other cities in Canada and the United States. Much of his time was taken up in making arrangements for street railway poles for future delivery.

C. L. Tolles held up the name of the Jewell Belting company of Hartford, Conn., in a very tempting manner before the delegates and visitors at the convention. Its appearance upon a fine pocketbook made it an attractive souvenir. The large supply was soon exhausted. Many questions were asked Mr. Tolles regarding the Jumbo 78 inch four ply belt which was sold the Washburn & Moen Manufacturing company of Worcester, Mass., in September, it being evident that power station managers are considering the use of large belts.

The Taunton Locomotive Manufacturing company of Taunton, Mass., had an exhibit of snow plows, one of which had the nose plow at both ends of car, showing that the track could be cleared by operating in either direction. The other had a side scraper of unusual width. This apparatus was of excellent manufacture, the cars being of new design, very strongly built for such heavy work, and were shown with commendable pride by their representative, Edward P. Sharp, assisted by Walter P. Trimble of Buffalo, N. Y.

President John J. Hogan, of the Hogan Boiler company of Middletown, N. Y., assumed charge of the exhibit of this company on Thursday, at which time the company was able to show the various important parts of its boiler to illustrate its many points of interest, all of which could not be mentioned in this short notice. It is enough to say that the large number of people that were continuously about this exhibit kept three attendants constantly busy answering the questions asked, and with few exceptions resulted in their being requested to give printed matter for future reference.

It was not generally known until the convention that the American Electrical Works of Providence, R. I., are the manufacturers of the American rail bond, and it therefore received unusual attention because of the wide renown for excellence of their productions. Samples of this T rail bond were eagerly sought, and their claims for high electrical efficiency, together with the best results, and its application to the rail, made strong talking points in its favor. This company is now prepared to deliver promptly telegraph orders for the various sizes, upon application.

A 500 horse power installation at the Royal Electric plant, placed by the Stirling company of Chicago, was referred to by that company as its boiler exhibit, and it was admired by a large number of callers. Its many features of excellence were fully explained by General Sales Agent Frederick A. Scheffler of New York. The Stirling company has several of its original boilers placed in Montreal and the Dominion of Canada, and it is preparing to extend its business in that section. Mr. Scheffler has proven to be the right man in the right place, as is shown by the manner in which the company's interests are taken care of.

One of the most interesting exhibits at the convention was that of the Fiberite company, manufacturer of the Medbery overhead material and other specialties. A full and complete line of trolley hangers, curve brackets, strain insulators, frogs, crossovers, station switches and waterproof sockets was shown, and it is safe to say that every practical railway manager examined with interest all of the devices shown. The fact that all of the street railway systems in Montreal are equipped with this material made the exhibit of special interest. The company was represented by H. J. Medbery, president, and W. R. Mason, general manager of the Mason Electric Equipment company of Chicago.

There was perhaps no exhibit that excited more interest among the street railway delegates at Montreal than the new material shown by Harold P. Brown of 68 Broad street, New York, which is called the Edison-Brown plastic rail bond. The statements made by Mr. Brown were of a most convincing character as regards the reduction of running expenses, and also the method of saving power and avoiding trouble from ruining the gas and water pipes, and in support of these statements he had fac similie copies of laudatory letters from some of the leading electrical engineers connected with the street railway business. The possibilities of quick application of this rail bond were highly commended.

The J. G. Brill company of Philadelphia had headquarters at the Windsor and a royal good welcome was extended to the host of visitors who continually crowded the headquarters. They had on exhibition beautiful models of late designs in single trucks, maximum double trucks, which also included elevater service. They had also a working exhibit that had been in use by the Montreal Park Railroad company and the Montreal Street Railway company. Vice-president J. A. Brill was ably supported by a reception committee consisting of General Manager Samuel Curwen, Assistant Secretary W. H. Huelings, Eastern Agent George Haskell, Central Agent M. Curwen, and Western Agent F. C. Randall of Chicago, who needed no introduction to the delegates from the central and western states.

The Westinghouse Electric & Manufacturing company of Pittsburg was represented in great style by 14 representatives, and although the company made no exhibit in the Victoria Rink, Westinghouse apparatus was in evidence on most of the street car lines in Montreal. One of these cars, No. 55, was fitted up with a special equipment showing how they run motor cars in northern Canada in winter time, having a thorough heating outfit. Among the representatives present were Ahearn & Soper, Canadian agents of the Westinghouse company, G. H. Lewars, Albert Schmid, E. N. Sanderson, J. A. Rutherford, A. F. Stewart, H. A. Craigin, R. S. Brown, E. F. Gordon, E. H. Heinrichs. The headquarters of the company were at parlor 213, Queen's Hotel. The Westinghouse boys were kept busy letting everybody know that Westinghouse apparatus was in as great demand as ever.

George S. Whyte, sales agent, Monadnock building, Chicago, had charge of the interests of the Chicago Insulated Wire company of Chicago and Sycamore, Ill., and the Badger Manufacturing company of Milwaukee, Wis. The Chicago Insulated Wire company's exhibit consisted of bare and insulated copper wire ranging from 500,000 circular mils stranded feeder cables to No. 35 B. & S. gauge magnet wire. The Badger Manufacturing company exhibited a complete line of overhead material, Badger fuse box, trolley base, Hoffman rail bond, etc. Mr. Whyte distributed attractive paper weights in the shape of Badger trolley bells in miniature. This is an improved form of W. E. hanger, so designed as to protect the cap holding the insulated stud from the weather and securely locking it so that it cannot become loose from the constant jar of the trolley. Mr. Whyte also distributed small spools of No. 35 B. & S. gauge magnet wire and a useful lineman's handbook of facts and figures for electric railway constructors.

The American Electrical Works of Providence, R. I., was represented by the treasurer, W. A. Hathaway, who made numerous trips with his friends to the factory of the Eugene F. Phillips Electrical Works, the Montreal branch of the company, where a most hospitable welcome awaited the visitors. They were taken in charge of Superintendent F. S. Mead, who showed them the interesting points of wire manufacture. John Carroll, of this concern, who has been located at Montreal for a number of years, will not be forgotten for his efforts in making the delegates' stay at Montreal one to be remembered with pleasure. P. C. Ackerman, the New York representative of the American Electrical Works, did not have to be introduced to the delegates. He knew them all; they remembered him with pleasure, and did not fail to give him a few quiet tips when their next order would be placed. F. E. Donohoe, the Chicago manager of the American Electrical Works, was at Montreal. He came with the western delegation, and contributed a large share of his time to their personal enjoyment while at Montreal.

The Babcock & Wilcox boilers were represented by the Canadian manager, William T. Bonner, who had a most attractive exhibit, comprising a full line of forgings, such as are used in the construction of the famous Babcock & Wilcox all-wrought steel boilers. In the background a number of large photographs of plants installed by the company were hung. Directly above the exhibit was suspended a banner from which some idea of the extent of the company's business was to be gained from the legend: "Over 150,000 horse power of the Babcock & Wilcox water-tube steam boilers are now in use by American street railways 1856–1895;" on the other side of the banner: "Over 1,500,000 horse power of the Babcock & Wilcox water tube steam boilers are now in use in all civilized countries." William T. Bonner, who is an engineer of large experience, having been connected with several large concerns, such as Fraser & Chalmers of Chicago, before joining the Babcock & Wilcox forces, took pains to explain to everyone the merits of the company's boilers. All their boilers for Canadian trade are now built in Canada, auxiliary works for the purpose having been recently established at Belleville, Ont.

The Goubert Manufacturing company's exhibit in the central space contained two fine models of the company's principal machines, the Goubert water-tube feed water heater and the Stratton steam separator. The Goubert heater has become a great favorite among street railway engineers, since it meets all the requirements of modern high-pressure plants. All standard heaters are built for 160 pounds' working pressure, although most orders call for pressures of 200 pounds and upward. The special feature of the Goubert heater is the copper expansion gasket, which allows the tube section to expand freely without affecting the joints in tube heads. All tubes are of brass, while the body is constructed entirely of cast-iron—a combination insuring sure protection from corrosion. The Stratton separators are guaranteed to furnish absolutely dry steam and consequently prevent breakdowns due to water in engine cylinders. Over 500,000 horse power are in use. In addition to the heaters and separators the Goubert company also manufactures surface condensers, ammonia condensers and other special machines, all combining the Goubert expansion joint and many other valuable features, all fully described in the company's handsome catalogues. The head office of the Goubert company is located at 16 and 18 Church street, New York. The principal works are located at Elizabethport, N. J., while auxiliary shops for the Canadian trade have recently been established at Belleville, Ontario. William T. Bonner is now general agent for the Goubert Manufacturing company in Canada, with head office at 415 Board of Trade building, Montreal.

The New York special left on Monday evening at six o'clock via the New York Central Railroad, Adirondack division, from Utica for Montreal, having a party of about 125 people. It was a jolly party, with no formality, which of course resulted in an exceedingly pleasant trip, and although arriving in Montreal a little late Tuesday morning, no fault was found in the service, because it was well known that two engines had unfortunately broken down while en route. The train was held at Montreal until Friday morning at nine o'clock, when the return trip was made, stopping at Saranac Lake for lunch, after which a delightful afternoon was spent by the party in a tally-ho drive and a trip to Lake Placid by rail. The arrangements were perfect in every detail and the best of service was given, and it was the general opinion that a more pleasant day could not have been spent. Taking the train after dinner at Saranac Lake, the party returned to New York, arriving Saturday morning in time for breakfast. When the New York Central & Hudson River railroad desires to have everything gilt-edged, General Eastern Passenger Agent Milton C. Roach of New York gets his hands on the wires that control. For his great interest in anticipating every possible need of the party on the New York special, they were unanimous in their thanks tendered Mr. Roach for the very delightful trip. Owing to his being called to New York he was obliged to leave the care of the special on its return trip in charge of Herbert D. Carter, who studied the interest of the delegation to the utmost satisfaction of all.

The Standard Paint Company of New York had one of the most attractive displays ever seen at a street railway convention. It was artistically arranged, and the companys' insulating compounds, armature varnish, insulating tape, water, acid and alkali-proof rubberoid roofing and roof paints were sure to catch the eye of the visitor in the exhibition hall, and in a most comprehensive manner were the many claims of their products presented. The P. & B. compound is largely used for coating lead-covered and other cables for underground use, for insulating overhead wires and re-insulating defective wires. The motor cloth has met with a most flattering reception, being made from a strong jute burlap, thoroughly saturated with P. & B. compound, which is thereby rendered perfectly waterproof. It is strong, durable and elastic and cannot be torn. P. &. B. armature varnish is made from the very highest ingredients and is without a rival. The P. & B. insulating papers are made from the best of stock and are water, acid and alkali-proof, ordorless and clean to handle. Large samples of products sufficient for practical tests are furnished to those interested. The P. & B. insulating tape is of peculiar value to street railways. It is made from a material that will not dry out and carbonize and always remains elastic. It possesses all the properties of the well-known P. & B. compounds and is therefore a perfect insulator as well as absolutely weatherproof. The Standard Paint company was represented by its general sales agent, F. S. De Ronde of New York, J. C. Shainwald, the Chicago agent, and H. F. Gillespie. A memoradum card case of unique design was a souvenir liberally presented to the callers at the company's headquarters.

## New Switchboard Instruments.

The accompanying cut illustrates a new type of switchboard instruments, amperemeters and voltmeters, which the Whitney Electrical Instrument company has just put on the market. They are of the electro-magnet type and are especially designed to meet the demand for a well made and thoroughly reliable yet inexpensive instrument. The working parts are incased in iron and sealed, thus shielding them from foreign influences and bodies. They are calibrated by hand, and careful comparisons are made with a known standard throughout the entire scale, thus insuring uniform accuracy. They are guaranteed to be within 1 per cent. of absolute accuracy.

NEW SWITCHBOARD INSTRUMENTS.

Although these instruments have been on the market but a few weeks, the demand has been so heavy that the factory has been run overtime to fill orders. They have been very favorably received in Canada, where they are in use by some of the largest manufacturers of electrical apparatus.

## Ohio Electric Light Association.

The annual meeting of the Ohio Electric Light association was held at Piqua, Ohio, October 8th. This was its first annual meeting, the association having been organized only in May last. The attendance at this first meeting was most gratifying under the circumstances. The secretary was able to report that the association now had on its membership roll nearly 50 per cent. of all the central station companies operating in the state.

The officers chosen at the preliminary meeting were re-elected for the ensuing year. They are: President, A. W. Field, Columbus Edison Electric Light company; vice-president, William C. Hedges, Mansfield Electric Light & Power company; secretary and treasurer, Samuel Scovil, Cleveland Electric Illuminating company; executive committee: B. P. Holmes, Youngstown Electric Light company; H. K. Wood, Piqua Electric company; L. C. Newsom, Columbus Electric Light and Power company. The constitution of the association, as originally adopted, provided for active, associate and honorary members. At the meeting at Piqua the constitution was amended so as to confine the membership to two classes, active and honorary members. Under the head of associate members the original intention was to afford representation in the association to any manufacturer of electrical apparatus or supplies. Under the constitution as amended, manufacturing companies cannot now obtain representation in the association. The following resolution was unanimously adopted:

WHEREAS, Certain manufacturers of electrical apparatus have in the past and are at this time attempting to secure

franchises for the installation of electric lighting plants in certain cities of this state; and,

WHEREAS, These franchises are not sought for the purpose of making a legitimate investment, inasmuch as the demand for electric service in these towns is not sufficient to support an additional company, but is rather for the purpose of compelling the existing companies to become customers of these manufacturing companies;

*Resolved*, That this association now puts itself on record as condemning such business methods as being neither more nor less than blackmail, and that such methods justify the association in requesting each of its members to refuse to purchase of such companies any apparatus whatsoever, if they thus continue their piratical attacks upon the invested capital which this association represents.

At the morning session of the association, October 9th, Caryl D. Haskins of the General Electric company read a paper on the use of meters and transformers, and the secretary was directed to have it printed and distributed to the members of the association.

## Dudley Individual Telephone Signal.

Telephone men throughout the West will be interested in the recent installation of a complete individual telephone signal system in the Oxford building, Chicago, where the operation of the apparatus can be examined and tested. Party line construction, which is the only solution of the problem of how to get reasonable rates from some telephone companies, involves the constant ringing of bells where ordinary construction is followed. It is to obviate this that the Dudley signal is designed. The installation at the Oxford building shows that the constant ringing of the bells and the necessity of a special ring for each subscriber are overcome by the use of the Dudley signal, which short-circuits all bells until the subscriber wanted is called, when that particular bell is cut in and rung by a device at the central office. The advantages claimed for the Dudley signal are that it is simple, inexpensive and easily adjusted. By its use practically individual wire service with party line construction is secured. The subscriber's bell does not ring unless called by Central. A substantial saving in construction and maintenance is effected and by short-circuiting bells it is claimed resistance is reduced and the service improved. A description of the device and its operation will be interesting. It is operated by a step-by-step movement and actuated by a central office transmitter or switch, as shown in Fig. 1. The central office instrument is connected with a battery, generator and a plug for the switchboard. When a subscriber is to be called, as, for instance, 3 in Fig. 1, the operator inserts the plug and turns the crank of the switch around to 3. Connection is made with the battery, which sends out impulses to all the signals which are wired into telephones at subscriber's station. On the ratchet wheel of the signal is placed a pin which makes the contact for the bell. If office 1 is required, the pin is placed opposite the first tooth of the ratchet wheel from the point alled the zero point; 2 opposite the second tooth, and so on, as many places as there are on that line. When in any office the bell circuit is completed it is broken in all the other offices on that line. The central office instrument, after bringing all the signals into unison, makes a second contact with the battery, and automatically works the signals the desired number of times, when that signal, as, for instance, 3, opens the circuit, and the generator, by a third connection made in the central office switch, rings the bell. Where a motor is used in the central office the operator simply inserts the plug and turns the crank of the switch to the desired number on the dial, and the subscriber is called automatically. Fig. 2 shows the device with the cover removed.

The Dudley system has been thoroughly tested in large and small exchanges with perfectly satisfactory results to the subscriber and central office operator. These devices can be used with any telephone on a grounded wire or metallic circuit, and the company is ready to guarantee its claims in every instance. The system is owned by the Dudley Electric Manufacturing company, with offices at room 65, 81 New street, New York, and room 721 Oxford building, 86 La Salle street, Chicago. G. W. Andrews, the genera manager of the company, is now in Chicago looking after the preliminary work of introducing the device to the western public.

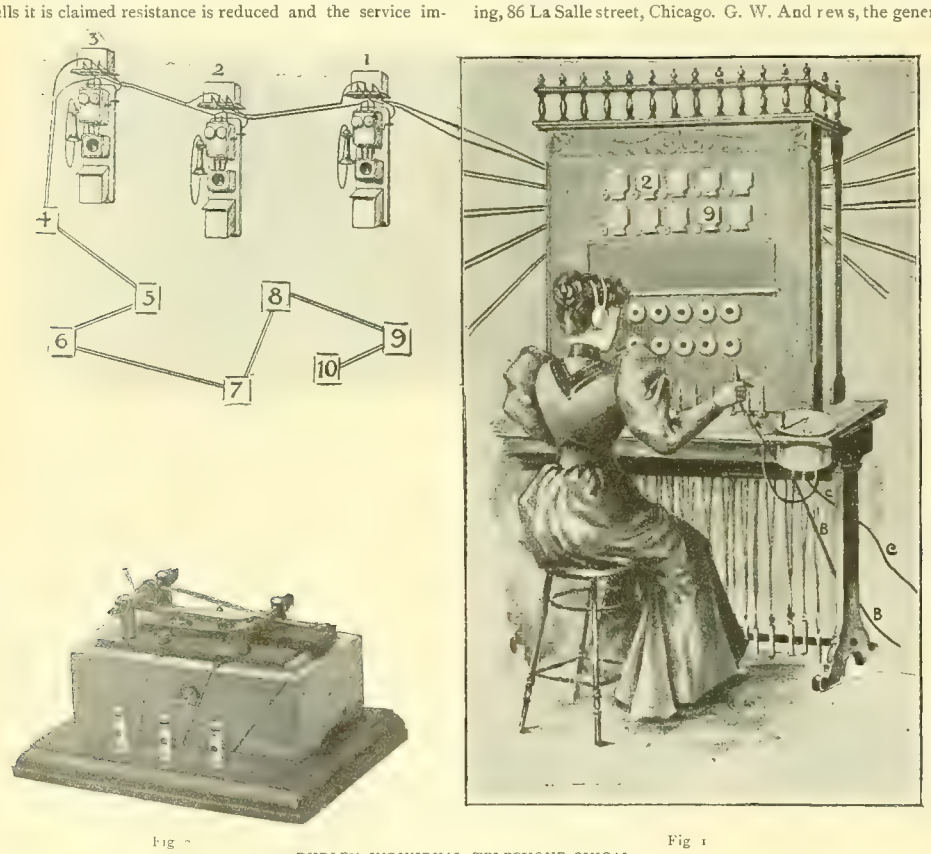
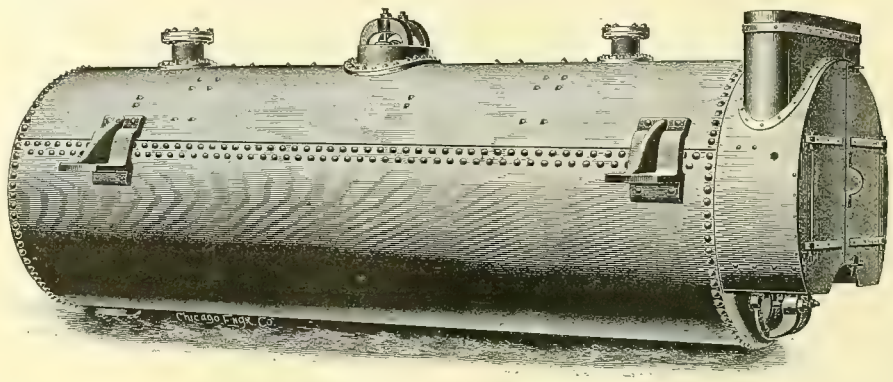



Fig 2 Fig 1

DUDLEY INDIVIDUAL TELEPHONE SINGAL.

## Murray Tubular Boiler.

Despite the claims set up by the makers of boilers of other types, it is maintained that the return tubular boiler still retains its position as the most satisfactory generator of steam. The manufacturers of this type have not stood still in the march of improvement by any means. Everyone knows, or at least remembers, the little local boiler shop that used to turn out boilers that were a patchwork of small plates. As the rolling mills began to produce the larger sheets heavier tools were required, and the modern boiler works now as well equipped with labor-saving appliances as any of its neighbors. Steam, hydraulic power, compressed air, and electricity are all employed in the construction of boilers, and the small hand-power shops are chiefly confined to repair work. The Murray Iron Works of Burlington, Ia., present an example of one of these modern plants, though the concern itself has rounded its quarter of a century. Their plant has been kept up with the times, and they are producing boilers built of the largest sheets of steel, with the minimum number of seams.



MURRAY TUBULAR BOILER.

The ideal boiler would be one without seams, but the one shown in the accompanying cut is as near as can be attained at present. The advantages claimed for boilers made in this manner are the following: There are no seams over the fire, and the bottom presents a smooth, even surface where contraction and expansion are uniform. In a boiler with the circular seams exposed to the fire the plates, already weakened by punching, are exposed to the strain of unequal contraction and expansion due to the lap and unequal heating of the inner and outer plates. The lap and rivets form a most convenient lodgment for mud and scale, are the most difficult parts to keep clean, and are usually the first places to show weakness and require repairs. The Murray Iron Works boiler is made in two longitudinal sheets, as shown, and has no dome. It is confidently recommended as a satisfactory steam generator.

## Hart Flush Switches.

The increasing demand for flush switches adapted to be set in a recess of the wall, with the finished metal cover practically flush with the surface of the wall, has led the Hart & Hegeman Manufacturing compaay of Hartford, Conn., manufacturer of the well-known Hart switches, to bring out an improvement in this line of goods. The company named was the first on the market with a flush switch made by attaching the switch to a rough cast plate for holding the switch to the wall, the whole being covered and concealed by a finished thin sheet metal plate with flanged edges held in position by the switch handle, which set in a recess in the face of this plate, thus avoiding any screw heads on the surface of the finished plate. These finished plates being made of thin metal, however, were very liable to become injured in use, and at the best were not perfectly flat, and in the right light many appeared wavy.

The new plate, illustrated in Fig. 1, is made of solid plate brass one-eighth inch thick, with edges milled to a bevel. The switch itself is attached to a brass ring *D*, Fig. 2, having ears *B* for fastening it to the wall. When this ring, with switch attached, is screwed to the wall the ears project to the extent of their thickness from the face of the wall, and are accommodated by pockets *C* in the back of the face plate *F*, allowing this plate to set back against the wall.

In all flush switches made on the old plan there is always a variation in the distance from the face of the plate to the porcelain base of the switch, and when the handle is screwed on it frequently binds on the plate, making it turn hard, and oftentimes breaking the handle, or else it does not screw down far enough to hold the plate in position, and allows it to rattle when the switch is turned. This difficulty is particularly noticeable in the gang plates for a number of switches, and if the handles are not put back on the same switches with which they were shipped from the factory, it frequently makes the construction men much trouble. This difficulty if now obviated by the self-adjusting handle, shown in Fig. 3. The collar *A* of this handle has a vertical movement with reference to the body of the handle of more than 1-16th inch, and is held downward by a flat spring, which it incloses and conceals. This spring-pressed collar holds the face plate firmly against the wall with an easy, elastic pressure. The shape of the handle is

easy to the hand, and the large section of material around the metal interior gives it great strength. The material is stronger than that heretofore used. The range of movement of the collar *A* compensates for all variations liable to occur in the distance from the face of the plate to the porcelain base of the switch. This adjustment makes all handles, switches and face-plates interchangeable, with no danger of the handles binding on the face-plates, either breaking the handles or causing them to turn hard, or of the face-plates being too loose. This adjustment is especially advantageous in gang plates. Single plates for all sizes of the Hart switches, and gang plates for any number of switches, are now furnished, made as described above, and with self-adjusting handles.

The dimensions of the different plates are given in Catalogue "B." Special plates of any required size are made to order. Gang plates are frequently furnished with bell buttons or automatic gas lighting buttons set in the plate. Plates finished in any of the standard finishes are carried in stock, and special finishes to match other hardware are furnished promptly.

## "Something New in Incandescent Lamps."

It is with this introduction that the Adams-Bagnall Electric company of Cleveland invites public attention to the latest productions of its factory. Last week the new arc lamp of the company was illustrated and described, and it is believed that the favorable impression which it made will be equaled by that produced by the incandescent lamp which is herewith illustrated. The "A-B" lamp is constructed without the glass tip on the large end, which is caused by welding a tube to the large end of the bulb and then sealing off close to the bulb when the air has been exhausted. In order, therefore, to get rid of this tip it is necessary to seal off at the other end, and to do this the usual glass mount must be abandoned. This changes the entire interior construction of an incandescent lamp, and the "A-B" lamp presents an entirely new appearance. The side of the bulb is drawn inwardly in the shape of sharp pointed projections, which take the place of the usual glass mount. The platinum wires are conducted through the walls of the bulb at diametrically opposite points, as far apart as it is possible to place them, and all trouble from short-circuiting at this point is avoided. A new feature in the manufacture of this lamp is the application of a small brass ferrule to the lamp during the process of construction. When the leading-in wires have been attached to the platinum they are laid along the neck of the bulb in small grooves provided for that purpose. Over these wires and the neck of the bulb is then placed the ferrule, which seats on the glass. The plaster or cementing substance is then placed in the open end of the ferrule, filling the grooves and depressions in the glass made for its reception. After this the bulb is exhausted and sealed off at the neck end. The lamps are placed in stock in this shape. It is claimed that with an open-end ferrule the plaster can be better applied to the glass than with a blind end base. The plaster being applied during the process of construction has ample time to dry and harden before the lamps can be shipped to market. This avoids all trouble arising from "green" lamps or lamps which will loosen at the base. This loosening at the base has been one of the greatest difficulties lamp manufacturers have had to contend with. A lamp base is not constructed with a view to its being attached properly by plaster to the neck of a glass bulb. This additional brass ferrule seems to perform an important function in thus overcoming a serious difficulty in the manufacture of incandescent lamps. The fastening of the lamp base to the ferrule is accomplished by mechanical means, and without loss of time in waiting for the plaster or cement to dry. Care has been taken by this company to select a very handsomely shaped glass bulb.

Fig. 1.

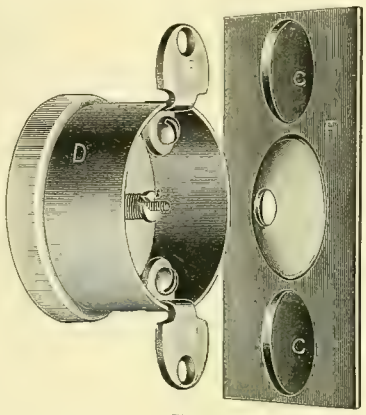



Fig. 2.

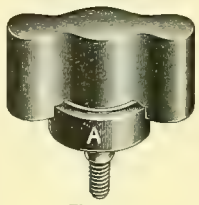



Fig. 3.

HART FLUSH SWITCHES.

## PERSONAL.

Elmer Sperry visited Chicago last week.

William H. McKinlock of Chicago was out of town last week making a business trip in the Northwest.

Chas. D. Shain of New York city was a visitor at the Chicago office of the WESTERN ELECTRICIAN last week.

Samuel F. Nichols, associated with his brother, George P. Nichols, in the practice of electrical engineering in Chicago, was married on October 17th to Miss Mary J. Forbes of St. Louis. During his residence in Chicago Mr. Nichols has made a reputation for himself as a thoroughly competent engineer, and his friends in the electrical field welcome the opportunity of extending hearty congratulations on his marriage.

## TRADE NEWS.

A. Chisholm & Co., Bay City, Mich., report that they mailed samples of their commutator compound to the street railways and lighting plants of the country last week. Any manager who has not received a sample may obtain one by writing for it. The compound is having a phenomenal sale in this country, with an increasing demand in Europe.

W. H. Schott, well known to the electrical trade, has opened an office at 1628 Monadnock block, Chicago, and is prepared to carry on a general construction business. Mr. Schott has been identified with the electrical business since 1884, starting with the old Thomson-Houston company, with which he was connected until 1889. After that he was with the Western Electric company, for which he installed and superintended many large and successful plants. Mr. Schott has been engaged in electric railway construction in the East during the past year, but has decided to make Chicago his headquarters. In addition to construction work, he is prepared to furnish specifications and attend to all details of construction work. He is making a specialty of going over present properties and planning improvements. He already has a number of large contracts in view, and if skill and integrity are worthy of success Mr. Schott will always be found with plenty of work on hand.

The Western and Middle States electrical trade will be interested to know of a new western connection recently made by a prominent eastern concern. For a long time General Manager Herbert H. Brooks of the American Circular Loom company of Chelsea, Mass., has felt the necessity of a Chicago office where western buyers of flexible conduit could receive the same attention as would be the case were they in direct contact with the eastern office. For this reason Mr. Brooks has established western headquarters in 1114 Marquette building, Chicago, and placed the business in the hands of A. D. Chandler as western manager. Mr. Brooks, however, expects to remain in the West and work in connection with Mr. Chandler throughout the coming winter. Already Messrs. Brooks and Chandler have felt the results of what has proved a wise decision, and the business thus far done by the western department of the American Circular Loom company would seem to indicate that the winter will witness a remarkable increase in the company's western trade. As is well known, by the use of flexible tube, objectionable joints in conduits are entirely eliminated, as the flexibility allows of bends of practically any radius. Each "run" may be an entire length, and the tubing's tightness in no wise depends on the nicety of fittings of a number of joints or the carefulness of the constructor. The flexible tube is constructed of a spiral of the best insulating fiber wound with a heavy Para rubber friction tape, over which is woven a continuous jacket of cotton similar to that in use in the ordinary garden hose, except that the stitch is much finer giving the quality of strong canvas. The tube is then saturated outside with an insulating compound, but the inside is left smooth and hard. It is finally run through powdered mica, thus producing a tube which is thoroughly flexible and waterproof and which is highly fireproof.

## BUSINESS.

The Electric Storage Battery company has closed a contract for a complete electric lighting plant for the New York residence of Charles T. Yerkes. The plant consists of an Otto gas engine, capable of giving 35 actual horse power. This engine is belted to a 30 kilowatt Siemens & Halske shunt wound dynamo, also a four-pole booster of 7½ kilowatts. The storage battery consists of 60 cells of type 25-G in lead-lined tanks. These cells have a capacity of 2,500 ampere hours at a 10 hour discharge rate, the maximum discharge rate being 500 amperes for four hours.

"SOMETHING NEW IN INCANDESCENT LAMPS."

Mr. Yerkes' residence, at Sixty-eighth street and Fifth avenue, New York, is wired for about 1,200 16 candle power lamps, and has besides an electric passenger elevator and several electric motors for ventilating, pumping and other purposes. This is believed to be the largest storage battery plant for private house use in this country.

The Phœnix Automatic Filter company of Racine, Wis., manufacturer of the Tracy oil filter, is very much encouraged by the success which has attended its recent efforts in pushing this device. The system of selling filters of a thoroughly reliable quality at a small profit is strictly maintained by this company. Its treatise on oil is now out and is sent free on demand. The Phœnix company also sends free assorted price lists. Central station managers throughout the country are becoming familiar with this device. Its simplicity is its chief feature. To operate it is only necessary to pour in sufficient soft water to fill the casing to the height of the water mark, then pour oil to be filtered through the funnel at the top. The oil descends into the distributing chamber at the base, where the flow is temporarily checked, precipitation taking place; it then passes through the distributing chamber, ascending to the surface of the water; the dirt and acid are partly thrown off; it then accumulates in the storage chamber, where further precipitation takes place. The oil gradually passes through clarifying disks into the accumulator, and as clean oil is drawn for use the accumulator is constantly refilled.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued October 15, 1895.*

547,760. Detachable Wire Tightener. Louis Bickel, Akron, O. Application filed July 11, 1895.

The claim is for a loop-frame having end guides and a lug catch, and oppositely disposed windlass bearings of different diameters, a windlass adapted to fit the bearings, cut diagonally between the bearings, and lengthwise from its face to its approximate center, and a sliding pin resting in a transverse orifice in the windlass longer than the diameter thereof, and arranged to fall by gravitation and engage the lug catch.

547,761. Street Railway Switch. Irving W. Bliss, Warren, R. I. Application filed October 5, 1894.

A roller having a pin in each end set on different sides of the center, single switch tongues hinged at one end so that their free ends can be raised and lowered, and having their free ends held on the pins in slots in the tongues of proper length to lock the pins when the tongues are raised, with means for operating the roller by an attachment on a car.

547,783. Conduit System for Electric Railways. John Hartman, Philadelphia, Pa. Application filed April 7, 1893.

The conduit is provided with a longitudinal slot, the insulator is secured to the inner walls of the conduit sections adjacent to the slot, and a conductor is embedded in the insulator, and it normally closes the slot, and has a portion depending through the insulator.

547,784. Supply System for Electric Railways. John Hartman, Philadelphia, Pa. Application filed August 7, 1893.

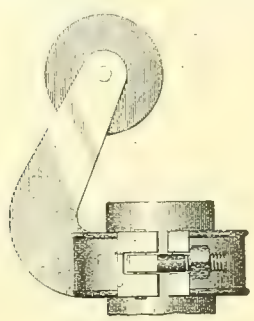
A continuous conduit is provided with parallel trolley grooves, the latter having therein the lead and return conductors respectively, each having on each side a metallic protecting strip, and being insulated from the other end from the sides of the grooves.

547,834. Electrical Transmission of Power. William D. Baldwin, Yonkers, N. Y. Application filed July 3, 1894.

The working motor has a constant field, and the armature of the generator is connected to the armature of the working motor; means are provided for automatically varying the current through the armature of the motor, and there is a switch at a distant point controlling the current through the field magnet coils of the generator.

547,835. Electric Car Lighting Apparatus. William Biddle, Brooklyn, N. Y. Application filed January 16, 1895.

The combination includes a secondary battery and light circuit, a circuit changer and an automatic circuit breaker, a dynamo having an armature with separate coils and separate pairs of brushes, one pair of brushes being always in position for action, and circuit connections from the same to the circuit changer and circuit breaker, and automatic means for varying the output of current from the other pairs of brushes and armature coils for unifying the current under the varying speeds of rotation of the armature



NO. 547,891.

547,836. Mining Machine. Henry H. Bliss, Washington, D. C. Application filed April 2, 1889.

The carriage is supported on a stationary frame, with the cutting apparatus at the front end of the carriage, the electric motor secured to the machine, automatically variable carriage feeding mechanism decreases the speed of the carriage independently of the rotation of the armature when the coal increases in hardness.

547,837. Mining Machine. Henry H. Bliss, Washington, D. C. Application filed April 2, 1889.

A portable bed is adapted to be made stationary; horizontal traveling guides are fitted thereto and form part of a reciprocating carriage; continuously moving cutters are supported on and across the front of the carriage. There are also a continuously moving chain for actuating the cutters, an electric motor secured to the carriage and moving forward and back therewith relatively to the bed, and having a continuously revolving armature adapted to generate momentum and connected by slowing down gearing with the chain which actuates the cutters, carriage moving mechanism rotating continuously when in action, and power transmitting means for the carriage moving mechanism connected with the slowing down gearing driven by the electric motor.

547,847. Combined Electrical and Mechanical Brake. James R. Cravath, Chicago, Ill. Application filed August 10, 1895.

This arrangement comprises an electrical brake, operated by a motor or motors rotated by the motion of the vehicle, a mechanical brake, a single operating lever or handle, a controller roller for controlling the circuits through the electrical brake, and locking and releasing mechanism for disconnecting the controller roller from the operating lever at a predetermined point in the rotation to permit the continued movement of the operating lever to throw on the mechanical brake.

547,861. Automatic Type Justifying Machine. James W. Paige and Charles R. North, Chicago, Ill. Application filed February 14, 1893.

The electrical features include a source of electricity, suitable electrical connections, an electro-magnet having its armature in operative connection with a lock, mechanism in connection with a clutch for restoring the returning bar to a normal position, a word key, a word shaft, intermediate clutching mechanism in operative connection with the word key, a lock for normally preventing the action of the word shaft clutching mechanism, an electro-magnet for releasing the lock, means for connecting the same with a source of electricity, an automatic circuit-maker and breaker adapted to act with each impulse of the machine, and a circuit-maker and breaker interposed in the circuit and in operative connection with the word key.

547,891. Apparatus for Placing Electric Cables. Edwin S. Reid, New York, N. Y. Application filed June 18, 1892.

The cut shows a post winch, comprising a clamp made in sections adjustably connected together, and having an adjustable locking device, a bracket attached to the clamp and extending upward, and a pulley supported in the bracket, the inner peripheral sides of which are practically in line with the center of the clamp, the pulley being adapted to be attached to a hollow post, and arranged so that a draw-rope passing over the pulley can pass through the center of the post and outside the post, where it may be reeled on an ordinary winch.

547,897. Electrical Succession Signaling or Calling System. James G. Smith, New York, N. Y. Application filed January 14, 1895.

Two wires run in opposite directions through several stations, one wire having electrical instruments connected with it, the instruments having individual circuits at the stations leading from the wire, the other wire having electrical devices to effect the breaking of the individual circuits in the electrical instruments at one station to permit the current to pass to the electrical instrument at the next station, and means connected with the opposite portion of the wire for operating the devices connected with the wires.

547,914. Series Electric Railway. Oliver B. Finn, Philadelphia, Pa. Application filed March 29, 1894.

There is a moving vehicle, an electrical conductor, a support therefor on the truck, and a depending arm on the car body, which arm engages the support.

547,930. Coupling for Electro-motors. Franz Marburg, Jr., Buffalo, N. Y. Application filed May 14, 1895.

Claim 1: The combination with an electro-motor and a main shaft to be driven thereby, of a friction clutch which couples said shaft and that of the motor, said clutch being adapted to operate through centrifugal force generated by the rotation of the armature shaft of the motor, and provided with means for proportioning said force to the speed of said shaft.

547,931. Insulator for Trolley Wire Supports. John W. Meaker, Evanston, Ill. Application filed November 19, 1894.

The device comprises a shell having a contracted lower portion, a sleeve engaging the contracted portion of the shell, and having its upper end rising above the contracted portion, and a bell suspended by the sleeve.

547,942. Electrical Succession Signaling or Calling System. James G. Smith, New York, N. Y. Application filed January 14, 1895.

Where there are several stations the combination is claimed of a normally closed line or circuit, having an electro-magnet included in it at each station, and two lines divided into sections by earth connections at each station, one wire including a signaling apparatus at each station.

547,960. Telephone System and Cable. Joseph W. Marsh, Pittsburg, Pa. Application filed May 6, 1895.

A telephone system is described, having the direct wires insulated and twisted together in pairs suitably for the use of each pair as a complete metallic telephone circuit, and having a common metallic return consisting of one or more pairs of wires insulated and twisted together suitably for use as one or more complete metallic telephone circuits.

547,979. Electric Heater. George H. Whittingham, Baltimore, Md. Application filed July 15, 1895.

This invention comprises a radiating pipe, a resistance wire extending through the pipe, an electric insulating, heat-conducting packing completely surrounding the resistance wire and filling the pipe, a binding post projecting from the side of the pipe and connected with the resistance wire, and a cap closing the end of the pipe and independent of the binding post.

548,011. Trolley Wheel. Henry Schmidt, Moline, Ill. Application filed January 5, 1895.

The claim: The wheel provided with an oil chamber concentric to the shaft or axle, and a series of rods or bars to support the material containing the lubricant, combined with the chambered sleeve placed directly upon the shaft or axle and upon which the wheel revolves, and which sleeve is provided with the openings and grooves, the openings communicating with the portions of the wheel hub which form its bearings and the opening at the lower side of the sleeve communicating directly with the oil chamber in the wheel, and the washers placed upon the shaft against the ends of the wheel and sleeve, a chamber being formed directly around the shaft inside of the sleeve, so as to hold the lubricant that escapes from the outer chamber in direct contact with the shaft.

548,027. Telephone Attachment. Charles H. Bernhard, Cleveland, O. Application filed March 15, 1894.

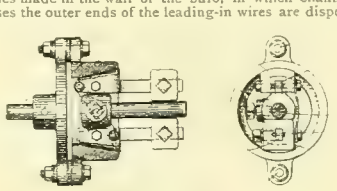
A support for the receiver is made at one end to engage upon the fork of the switch, and at the other end to engage the cord of the receiver, and having an elastic body.

548,028. Electric Arc Lamp. Charles Beseler, Jersey City, N. J. Application filed May 4, 1895.

The device described comprises a base carrying the lamp, a lever fulcrumed on the base and provided at one end with a pin or pins adapted to rest on a fixed part of the magic lantern, and a screw rod screwing in the rear end of the lever and resting on a step in the base, so that when the screw is turned an inclined position is given to the base.

548,036. Incandescent Electric Lamp. Samuel E. Cox, Cleveland, O. Application filed July 18, 1895.

The first claim follows: In an incandescent electric lamp, the combination, with a bulb, of leading-in wires passing through and sealed in the walls thereof, and channels or recesses made in the wall of the bulb, in which channels or recesses the outer ends of the leading-in wires are disposed.



NO. 547,930.

548,038. Thermo-electric Generator. Harry B. Cox, Hartford, Conn. Application filed January 31, 1894.

The method of making thermo-electric couples consists in forming a thin hard metal strip element, and a comparatively large metal element of a lower fusing point than the strip element, then passing an electric current through the large soft metal element and thin metal strip, which are properly proportioned, so that the hard metal fuses to the soft metal to form the alloy of the metals of both parts and unite them by graduated alloy junction.

548,032. Supply System for Electric Railways. Henry V. Brown, Brooklyn, N. Y. Application filed November 21, 1894.

The combination comprises a main circuit, vertically shiftable current carriers arranged to be normally out of contact with the main circuit and a catch adapted in one position to restrain and in another position to release the carriers, and an electro-magnet arranged to actuate the catch, and being momentarily electrically connected with the next preceding current carrier.

548,070. Electric Railway System. John La Burt, Brooklyn, N. Y. Application filed June 26, 1894.

The first claim is for the combination of a track section and a section at one side thereof forming the walls of a conduit, a contact line in the conduit, rock levers supporting the contact line and having insulated pivotal connection with the track section, contact plates carried by the lower portion of the rock levers, a main conductor located outside the conduit, and the contact pieces having connection with the conductor.

548,074. Trolley Rope and Pole Controller. Charles A. Lord, San Francisco, Cal. Application filed January 9, 1893.

In combination with and mounted upon a trolley pole is a tension device for the trolley rope, consisting of a hollow reel, a hollow barrel inclosed within the reel, a spring within the barrel, having its ends connected respectively to the barrel and the reel, and a bracket for supporting the parts secured to the pole.

548,126. Electrical Illumination. Daniel McF. Moore, New York, N. Y. Application filed October 13, 1894.

A system of electrical phosphorescent illumination is described, consisting of an evacuated inclosure, a tube communicating therewith and extending to distant points, an electric generator, electrical conductors extending therefrom and passing through the evacuated space, and means for making and breaking the circuit within the vacuum.

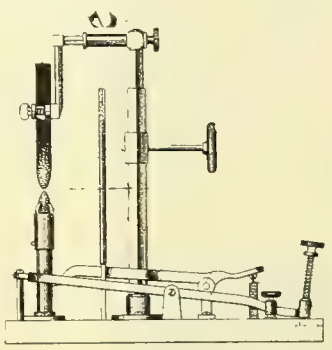
548,127. Electric Lighting System. Daniel McF. Moore, East Orange, N. J. Application filed July 19, 1895.

The improvement consists in causing repeated absolute interruptions of a circuit of induction by sudden interpositions of an infinite resistance, and utilizing the electric waves or disturbances so generated to produce luminous effects.

548,128. Electric Lighting System. Daniel McF. Moore, New York, N. Y. Application filed April 10, 1895.

A number of electrical lamps are used, each consisting essentially of a rarefied receiver adapted to be rendered luminous by electric undulations or disturbances; there is a generator in a circuit common to such lamps, a shunt or branch of self-induction around each lamp, and means for rapidly interrupting the current of the generator.

548,129. Method of Electrical Illumination. Daniel McF. Moore, New York, N. Y. Application filed December 4, 1894.



NO. 548,028.

The Geissler tube effect is attained by producing light throughout a vacuum traversed by an electric current, intermittently interrupting in the vacuum the current and producing and maintaining the atmosphere of the vacuum sufficiently rare to effect an apparent continuous generation of light at all points of the atmosphere within the inclosure.

548,130. Regulation of Electrical Phosphorescent Illumination by Magnetic Induction. Daniel McF. Moore, New York, N. Y. Application filed January 3, 1895.

This is accomplished by the combination with an evacuated inclosure of vibratory electric terminals therein means for interrupting the circuit at the terminals, and an electric conductor extending by itself alone from one of the terminals only, and throughout the evacuated inclosure and independent of a return circuit.

548,131. Apparatus for Generating Phosphorescent Electric Light. Daniel McF. Moore, New York, N. Y. Application filed January 7, 1895.

The illuminator consists of an evacuated inclosure, electric terminals therein normally just escaping contact with each other, and means for moving them relatively without touching.

548,132. Phosphorescent Electrical Illumination by Oscillation. Daniel McF. Moore, New York, N. Y. Application filed January 9, 1895.

An evacuated inclosure and relatively yielding electric terminals therein, normally separated from each other and forming the terminals of an electric generator.

548,133. Phosphorescent Electric Illumination by Intermittent and Permanent Interruption in Vacuum. Daniel McF. Moore, New York, N. Y. Application filed January 24, 1895.

An evacuated inclosure with separable electric terminals included in an electric circuit, a conductor forming an extension to one of the terminals and located in the inclosure, another conductor connected to earth and extending within the inclosure so that there is a rarefied air gap between itself and the extension.

548,134. Electrical Illumination by Phosphorescent Flame. Daniel McF. Moore, New York, N. Y. Application filed January 25, 1895.

The flame producer consists of the combination of an evacuated inclosure, movable terminals of an electric circuit therein, and electric conductors of similar polarity and connected to one of the terminals and extending through the evacuated space and in loose contact with each other at points.

548,150. Electrical Gold and Silver Extractor. Alfred Williams and William R. Phillips, Seattle, Wash. Application filed January 24, 1895.

This invention includes an insulated cylindrical box, rotary about a vertical axis for the purpose of containing mercury and other liquids, an electric terminal of a given polarity fixed upon the inner side of the cylinder, and at or near the top thereof an electric terminal of the opposite polarity fixed upon the bottom of the cylinder and within the same at or near the center and away from the periphery thereof a rotary shaft carrying the cylinder and provided with a driving pulley and with electric collecting rings connecting with the respective electric terminals above named, a stirrer extending eccentrically into the cylinder, and means for vertically reciprocating the same.

548,162. Combined Diaphragm and Electrode. James Hargreaves, Farnworth-in-Widnes, and Thomas Bird, Cressington, near Liverpool, Eng. Application filed December 31, 1894.

The method of manufacturing a combined porous diaphragm and permeable electrode consists in depositing directly upon a metallic permeable electrode a plastic mixture of alkaline earth and fibrous material, drying the same, and then steeping the plate in a solution of such a nature as to convert the alkaline earth into an insoluble binder.

Western Electrician.

EVERY SATURDAY.

Vol. XVII. CHICAGO, NOVEMBER 2, 1895. No. 18

## Electric Propulsion of Canal Boats.

An official test of the application of electricity to canal boat towing was made at Tonawanda, N. Y., on October 26th, and it was in every way satisfactory. The test was conducted under the auspices of the Cataract General Electric company and in charge of Frank W. Hawley, vice-president of that company. So great was the interest manifested in the affair that it was the occasion of a gathering of prominent citizens and state officials, among them being ex-Governor Roswell P. Flower, State Superintendent of Public Works George W. Aldridge, State Electrician Charles R. Barnes, State Engineer and Surveyor Campbell W. Adams and his assistant, T. C. Leutze, Hon. W. Caryl Ely and many other representatives of state, vessel and shipping interests.

Preparatory to the test a cableway line one and 21-100 miles long was erected along the tow path on the south bank of the Erie canal, the poles being about 16 feet high above the ground level, well braced, and 125 feet apart. A view of this construction is shown in the cut on this page. In all respects the construction and cable were such as to inspire confidence, which was not marred by anything that occurred during the test, but, on the contrary, it was increased. The state officials and other guests took their places on a boat soon after three o'clock, and their number was largely increased from the gathered crowd until the boat was well laden with curious, anxious humanity, all eager to witness this latest ambition of electricity to enter the field of canal boat propulsion and aid in building up anew the commerce on the great waterway. Current for the experiment was obtained from the power house of the Buffalo-Niagara Falls electric railway. Master George W. Aldridge, Jr., son of the state superintendent of public works, turned the switch by which the connection was made. Richard Lamb, the inventor of the motor tested, acted as motorman, and at 3:30 P. M. he threw open the little lever that started his device off over the cableway at good speed. This set the crowds on the banks, boats and bridges to cheering, and seldom has the work of electricity been so heartily applauded.

In the multitude were hundreds of canal men, who felt at once, as the motor moved easily, gracefully away, that they saw in its efficiency the freedom from slow animal power for which they had for many years been longing. To them it was the commencement of a brighter, better, more prosperous era, and glad was the welcome they extended. Up along the cableway the motor sped, towing with good speed, against wind and current, the loaded boat until the end of the line was reached. Then it was noticed that the motor had warmed slightly, but not sufficiently to delay its return. The towline of five boats loaded with people anxious to ride behind the new "electric mule" was fastened to the motor and the return trip commenced and ended as successfully as the up trip. During the up trip, against wind and current, the motor towed the single loaded boat at the rate of 3.6 miles per hour, while on the down trip with five boats, wind and current favorable, the speed was at the rate of 4.7 miles per hour.

The motor used was of 25 horse power capacity. The upper cable, the one on which the motor rests its weight of 1,200 pounds, is made of the hardest crucible steel, having a tensile strength of 132,000 pounds, whereas the tensile strength of ordinary steel is but 60,000 pounds. In diameter the cable is 1¼ inches. The civil and electrical engineers present were especially pleased with the work of the motor and the arrangement. They were much surprised that the motor, as it approached a given point, did not pull the sag out of the lower cable and draw it taut for a distance to exceed one span ahead of the motor, thus demonstrating that any number of motors can be used on the same line, when pulling in the same direction, without influencing the cable but a few feet ahead of it.

While the boat was under way on the up trip Frank W. Hawley's private secretary read this telegram from Governor Morton:

I am in receipt of your letter of October 20th, inviting me to attend the official test of your system for the propulsion of canal boats by electric power, and as you are aware, from my former communication on the subject, I had hoped that I might be able to witness this public demonstration of the efficiency of your great project. Engagements already made, however, interpose to prevent my acceptance and I much regret that I cannot be with you.

The achievement of success in so important a scheme as the application of electricity as a motor for canal traffic is an event fraught with such deep interest to the commercial community, and therefore to the whole people, that I can-

Side View of Lamb Motor.

Scene of Experiment at Tonawanda.

Lamb Equipment With Operator in Position

ELECTRIC PROPULSION OF CANAL BOATS.

not let pass this opportunity of saying how deeply I am concerned in your enterprise and its ultimate success. It promises, in larger measure than any other factor, a present solution of the great problem of canal transportation for the Empire State, which is the key to the geographical position of a water route from the great lake system to the Atlantic ocean. Various projects are on foot, in more or less advanced conditions of scientific and physical development, for the enlargement of the traffic capacity of the canals of this state, but the simplest and least costly of them must involve the expenditure of millions of money and occupy many years of time for their accomplishment.

Your project promises, through the medium of scientific intelligence and praiseworthy private enterprise, to so multiply the immediate present scope of the canal service as to furnish with present conditions all the actual carrying capacity that may be required for some years to come.

When the great ship waterway from Chicago to New York harbor, which is no longer a dream but a scientific certainty of the not remote future, shall be achieved, your plan of propulsion for vessels will be more than ever a requisite for the movement of the still heavier vessels that will carry the trade.

I repeat my regret that I cannot be with you on this interesting occasion, but I take pleasure in assuring yourself and your associates in this splendid enterprise of my sincerest wishes for its success.

Ex-Governor Flower made a speech in which he pointed out the vast benefits that would result from the application of electricity to the canal by giving cheaper transportation and greater facilities to compete with railroads, a factor of importance to the East and West.

State Electrician Barnes, who was a careful observer of everything connected with the test, made this statement:

The entire success of the experiment is exceedingly gratifying to me. I have been engaged with electrical affairs exclusively for the last twenty years, and have been interested in this line especially of late. I was present as electrician in behalf of the superintendent of public works of this state in the fall of 1893 when the first experiment was made at Brighton to propel canal boats by electricity; and I have during a considerable period been looking forward to and expecting the successful solution of the problem of the application of electricity as a motive power on our waterways, in such a cheap, convenient and certain form as would commend it to shippers and boatmen and induce its immediate use for that purpose everywhere and particularly upon the canals of this state.

I have no hesitation in saying that the test was entirely successful, and demonstrated to my mind the fact that it may and will be applied generally upon the canals of this state, and that it will result in very materially cheapening the cost of canal transportation as well as increasing the speed of boats. Taken in connection with the proposed improvement of the state canals, it will result in greatly increasing the capacity of the canals for transportation purposes; it will cheapen the cost of the same, and it will thus increase the power of the canals to control the freight rates between Buffalo and tidewater.

The cheapness at which the electrical power can and will be furnished from Niagara Falls for this purpose is assured by contracts already made by the traction company engaged in making the present experiment, and with a wise and prudent management I am sure that all the results I have predicted must follow.

In what I have said in relation to the plan adopted in the test at Tonawanda, I do not mean that the particular plan or machinery there used is the only or best one which ingenuity may devise in the future, but I do mean to be understood that this particular plan is simple, cheap, can be readily and cheaply applied to the present canal boats and will successfully do the business.

The test made was under the authority and direction of the superintendent of public works, with the approval of the state administration. The Legislature had authorized experiments to be made in applying electricity to the propulsion of canal boats; it subsequently authorized the Public Works Department to enter into a contract with the Cataract General Electric company for the equipment of the canals with some system of canal towing, but first to be duly approved by the superintendent of public works. A contract drawn by Governor Flower was entered into with the Cataract General Electric company, which was authorized during the term of 50 years to construct, maintain and operate a system of canal boat propulsion upon all of the canals of the state of New York. It permitted the use of either or both banks of the canal, and all canal lands, provided that the present method of towing was not interfered with. It has also allowed the Cataract General Electric company to carry its power mains over all canal lands, through cities, villages and towns along its line for local distribution, thus relieving the company from the necessity of securing municipal franchises. The company entered into a contract with the Erie Canal Traction company to apply and operate the towing line at a cost not to exceed $3,000,000, which amount was subscribed. It being necessary that the system should be first approved by the superintendent of public works, the Cataract General Electric company made this its second test of the value of electricity for the propulsion of canal boats. The first system submitted and tested was fully approved by the state authorities, but the Cataract General Electric company believed it would be better to test also the cableway or traction system.

The electrical equipment employed in these experiments has been pronounced simple in construction and highly efficient by engineers who have looked into the subject. In the cut on the preceding page, beside the general view of the scene of the experiment, there will be seen in the upper left-hand corner a side view of the Lamb motor, and in the lower right hand corner a reproduction of the trolley equipment with the operator in position. In preparing the line for the

Application of Lamb Motor Which Suggested the Idea of Adapting it to Canal Boat Towing

ELECTRIC PROPULSION OF CANAL BOATS.

experiment brackets were erected upon posts or supports, and saddles placed upon the brackets with insulated material between them. The saddles are designed to prevent short-circuiting. A bracket is also provided to support the lower or traction cable. It is not insulated, but at intervals along the line some of these brackets are grounded. A steel cable of 1¼ inches is supported upon the upper saddles and a five-eighth inch steel cable upon the lower. In canal boat towing the cable line is placed on the inward side of the tow-path. The bearing cable is placed at an elevation of 16 feet from the ground, and the traction cable three feet below it. The motor truck is made with two deep grooved wheels to run on a cable, having a horizontal axle between them and below their center line. Upon the axle is suspended a hanging frame having attached to it an elliptically grooved sheave which is revolved by means of a worm or wedge-gearing, driven by a 15 kilowatt electric motor with vertical shaft, all attached to the swinging frame of the car. By taking three turns of a five-eighth inch cable around the elliptical grooved sheave, when the electric motor revolves the gearing the sheave winds up, and at the same time pays out on the five-eighth inch cable, thus pulling along the car. It is in this way that the motor gets its tractional friction independent of the weight of the apparatus.

A 500 volt current is used. It is taken from the main cable through the wheels, thence through the axle to the axle-box of the hanging frame. Here an insulated copper wire connects it with the rheostat. The current is returned through the traction cable which is grounded at intervals, giving a combined ground and metallic conductor for the return current. The return current is passed through the axle of the elliptical grooved wheel; thence on to the five-eighths-inch wire to the brackets; thence through a wire to the ground and to the pole of the generator.

The motor is not confined to a straight line in its ability to operate, for when it reaches the bracket the traction cable is lifted from the saddle momentarily, and the car can take a new course. The saddles are made so that the wheels leave the cable and ride over on their flanges in the channels of the saddles made for straight line or right or left deflections. The main cable is used as the electrical conductor. It is insulated at the brackets, by insulating material placed between the saddle and the bracket, and the current is prevented from passing down the frame of the motor by insulation at the point on the frame where the axle-box joins the frame proper. The points of insulation are provided in their construction with hoods to shed water.

The worm gear for this motor is designed to work both ways, and has ball-bearings at either end of the worm to lessen the friction and thrust. It differs from an ordinary worm gear in that it has more than twenty times the bearing surface of an ordinary worm and wheel, moves two teeth of the gear wheel at each revolution of the worm, and works on the principle of a wedge rather than an incline plane. The gear wheel, worm and ball-bearings are encased in a jacket filled with oil. The gearing was necessary in order to lessen the speed, as the electric motor is run at 1,240 revolutions per minute.

When a motor is to be run without any boats in tow its rheostat and conducting wire tow-line are placed upon the motor, and a driver, perched on a seat on the motor, operates it.

Housing the Canal Motor of To-day.

ELECTRIC PROPULSION OF CANAL BOATS.

The rheostat has an automatic switch. Four insulated copper wires armored with steel wire form the cable that conducts the electricity from the bearing cable to the rheostat on the boat and back to the motor, and at the same time acts as the tow-line. The upper end is clamped to a ring that runs on a traveler situated on the frame of the motor about the lower part of the elliptical wheel. A long steel clamp with toggle joints is used to hold the towing cable at any point desired, and has a ring in one end, to which is attached a short length of rope, which is made fast to the sampson post of the boat. The end of the towing cable is carried to the rheostat on the boat, where it is coupled to a similar piece of cable wired to the terminals of the rheostat. The coupler is designed so that it is impossible to join other than the right wires together, and the contact is made quickly and securely.

Another view that is presented on this page shows the

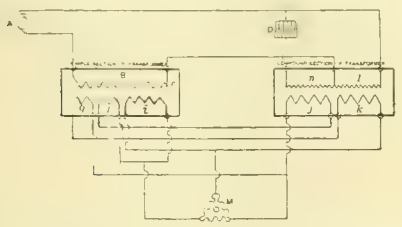


FIG. 1. PHASING TRANSFORMERS.

first application of this system. The same principle is employed, and the apparatus used on Saturday at Tonawanda is simply a development of the idea which was first put into practice by Mr. Lamb in hauling logs in the woods of North Carolina. A biographical sketch of the inventor and some account of his work in developing this system will not be out of place here.

Richard Lamb, the inventor of the electric cableway, was born in Norfolk, Va., in 1859. His paternal ancestors for five generations lived in Norfolk, and his great grandfather, grandfather and father have served as mayor of that city. Mr. Lamb was with his father, Col. William Lamb, at Fort Fisher during both of the terrific bombardments during the war. Col. William Lamb built and gallantly commanded Fort Fisher during both of those memorable engagements. Mr. Lamb's maternal grandfather was E. M. Chaffee of Providence, R. I., a distinguished and successful inventor. Among his inventions was the present mode of making rubber shoes, the old way being to mould them in the shape of shoes when the rubber was coming from the trees. He designed the Corliss engine that was so famous at the Centennial Exhibition at Philadelphia. So Mr. Lamb comes naturally by his engineering and inventive ability. He took part in the United States government survey at the Chesapeake & Albemarle canal and Currituck sound during the year 1878. He finished his course in civil engineering at Brown University in 1883, where he had the advantage of studying electricity under Prof. Blake, whose work on the telephone is well known. He worked for a time in the city engineer's office at Providence, R. I. He was constructing engineer of the Norfolk system of sewers, when he built miles of sewers through quicksand, and introduced several novel methods of constructing sewers. It was at this time that he invented, and put into practical use an automatic electric starter and stopper of the sewer pump. Mr. Lamb made the survey and plans for the draining of the great Dismal Swamp. His report to the owners of the swamp was very generally published throughout the country. He was constructing engineer of the great Pocahontas coal pier of the Norfolk & Western railroad at Norfolk, Va. At this time he met his wife, the daughter of the Hon. Henry E. Knox, a distinguished lawyer of New York. He decided to live in New York, and with his brother engaged in introducing North Carolina pine in New York and New England. Their great success in this undertaking is generally known to the lumber trade. It was out of this work in the lumber camp that Mr. Lamb came to develop the system of canal boat propulsion which has just been tested on the Erie canal. During 1887 and 1888 Mr. Lamb undertook the development of the timber resources of Onslow county, N. C. He secured extensive tracts of timber land and built a mill at Jacksonville on the New river. During 1893 Mr. Lamb, while carrying on an extensive wholesale lumber business, laid out and drained the town of Lambert's Point, Va. It was in conjunction with this business that he invented his steam and electric cableway. He had his plant made at the works of the Trenton Iron company of Trenton, N. J. The scheme proved practicable, and Mr. Lamb was enabled to get logs from the swamps heretofore practically inaccessible. It occurred to him that he could take the same boiler and engine and deliver the same power a far greater distance into the swamps by sending the power through the bearing cable in the form of electricity, and that, unlike steam cable systems, it would not have to be run in a straight line. Mr. Lamb found, on investigating the state of the art of telpherage, that other systems had failed owing to the fact that to obtain the necessary weight to secure tractional friction between the wheels and the cable, the motor had to be made heavy, which sagged the cable and increased the incline of the cable which is met on approaching the supports. He overcame this difficulty by building a machine that would carry its tractional friction independent of the weight of the apparatus. This he did by having a flexible steel cable anchored at both ends. Several revolutions of this cable are made about an elliptically grooved wheel, which is turned by an ironclad electric motor. In this way the motor is hauled beneath and upon the bearing cable. The effect is like a steam windlass on a boat, where one end of a cable is anchored and several revolutions of the rope is taken about the capstan, and the slack is hauled in; or, like an elevator, where a sufficient number of turns has been taken about the drum to provide friction to sustain the weight of the car. In the Lamb electric cableway the hauling cable is kept parallel with the bearing cable. Hence, when the motor is climbing the inclination of the rope, the direction of the pull is in the best possible direction to save power. This feature insures for the system a great future for mountain cableways, where steep grades are to be overcome. The original plant that was built was erected for trial on the sides of the Delaware & Raritan canal. Seeing some mules hauling a canal boat at a slow pace near his work, Mr. Lamb naturally thought of relieving their burden by taking their towlines. On testing canal boat towing the system proved from the start to be excellent. Subsequent tests were made in pulling the boats around sharp curves, which also proved entirely satisfactory. Mr. Lamb then put up his plant in the swamps of North Carolina, and later in Virginia, where he is now hauling logs. With a plant generating its electricity by a 20 horse power engine he can go into a swamp and pull out logs for a distance of one mile, pulling in the logs from either side of the cable for a distance of 500 feet by a

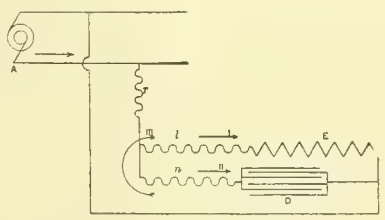


FIG. 2. PHASING TRANSFORMERS.

lateral hauling device, also of his own invention. He has also designed an electric saw that takes its current from the main cable of his electric logging rig. Its crew consists of a foreman who rides a motor, and thus can superintend all branches of the work, an engineer who fires the boiler, a terminal man who unloads logs and cuts wood for the engine, three men and two tree sawyers, in all eight men. Both in the forest and on the canal Mr. Lamb has designed the system so that no knowledge of electricity is necessary on the part of these workmen. The success of the scheme as applied to canal boat propulsion is attested by the reports of the witnesses of last Saturday's experiment.

## Phasing Transformers.[1]

By Charles S. Bradley.

On account of the large number of single-phase plants in existence which were built for lighting, and with no thought at the time of running motors from these systems, it has seemed to the electrical engineer very necessary to produce a single-phase motor. Many talented men have labored and studied upon this subject, and, so far, the results have not been at all satisfactory.

During the last few years the rapid progress of the polyphase motor has been the only success. The evolution of electrical art seems to be toward the production of apparatus which shall make all systems mutually convertible, so that we may be able to convert the phases produced into a greater or lesser number. Starting with a generator of three phases, we shall be able to produce from it two or one. Again, generating two phases, we shall be able to convert it into three phases or one. Again, starting with a single-phase generator, we shall be able to convert it into two or three phases.

The polyphase motor is so good as to need but very little, if any improvement, but this is so familiar to the Institute that I need not go into details. I think the time is not far distant when we shall be able to fill out with the alternating currents any engineering problem that may be required of us. We will be able to take old plants and modify them to do any work which may be necessary. One of the important links to round out the art seems to be the phasing transformer, so that we can take a single-phase alternating current and convert it into polyphase of any desired number.

I have chosen for my work the conversion of single-phase to three-phase, because the three-phase motors which we have been able to construct give us very much less trouble than the two-phase. In a series of experiments I have found that the two-phase motor would run at a number of speeds, especially when supplied with current from a phasing transformer. I supposed the trouble arose from harmonics, but of this I am not certain. The triphase motor never has given us any of this trouble. These experiments, however, were carried out before the transformers had been refined; and, now that we are getting more perfect results, I think it is very probable that we could return to the two-phase motor and get much better results than when first tried. The following is a description of an arrangement of condensers and cores to produce polyphase and single-phase alternating currents. Many different arrangements of condensers and inductances have been tried, and all have failed to keep their phases at a working relation, except the one I am about to describe.

A diagram of the phasing transformer and connections with the generator and motor will be found in Fig. 1, *A* being the generator, *B* the simple section of the transformer, *D* the condenser and *M* the motor; *r*, primary of the simple section of the transformer; *n* and *l*, primary of the compound section; *g*, *h* and *i*, secondaries of the simple section of the transformer, and *j* and *k* secondaries of the compound section. The primary of the simple section of the transformer is in series with the compound section and condenser. By the proper adjustment of capacity and inductance, the magnetic flux in the core of the compound section is approximately 90 degrees in phase behind the simple section, then, in order to get three phases from the two, I resort to resultants in the secondaries; *g* and *k* constitute one phase, *h* and *j* a second, and *i* the third. The essence of this invention rests in the arrangement of the compound section of the transformer and condenser. There are, undoubtedly, several ways of explaining the theories involved in this device, and most people would prefer the mathematical description, but as I did not hit upon the invention by that method, I shall follow in the explanation the same method of reasoning that I used to arrive at the result. In order to explain the theory involved in this, refer to Fig. 2, in which *A* is the generator, *E* the inductance, *D* a condenser, *l* and *n* represent the leads to the inductance *E*, and to the capacity *D*. If the generator is generating an electromotive force in the direction of the arrow, Fig. 2, a current will flow through the lead *l* and the inductance *E*, as represented by the arrow prime, and through *n* into *D*, in the direction of the arrow second, as indicated by the curves in Fig. 3; that is during the rise of the electromotive force through the machine from the point *o* to the top of the wave at *p*, the current will flow in parallel into or through the inductance *E*, and the capacity *D*, Fig. 2. As soon as the wave of the electromotive force commences to decline from the point *p*, the condenser will begin to discharge and the current flowing from it will be in the direction of the arrow third, Fig. 2. Also, at the same time, the inductance will discharge its energy by a current in the direction of arrow third, so that the current represented by arrow third will cross the zero line at point *t*, Fig. 3, or is delayed by a time equal to 90 degrees. Thus we see that the current represented by arrow third will be lagging in its time period considerably behind that in the lead *r*, represented by curve *o–p*. Now, if we wind the lead *l* and the lead *n* upon an iron core as shown in Fig. 4 in opposite directions and of the same number of turns, and have the inductance *E* bear a proper relation to the capacity *D*, so that the currents represented by arrow prime and arrow second shall be equal, no magnetic flux will be produced in the core during the rise of the potential of the machine from *o* to *p* on the curve, but during the fall of the electromotive force of the machine and during the discharge of the inductance and condenser which is represented by arrow third, Fig. 2, the currents flowing through *n* and *l* will be in series and flowing in the same direction; consequently the magnetic flux will be approximately 90 degrees later than it would be if charged directly from the machine. I have represented in Fig. 2 a section of lead by *r* and it will now be clearly seen that the current in the lead *r* will have a phase difference from the combined or resultant phases in the leads *l* and *n*. Furthermore, a current in the lead *r* will be in lead of the electromotive force of the

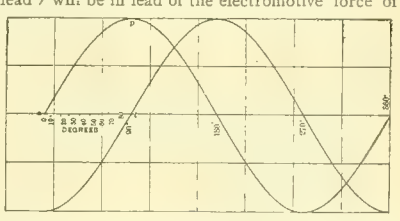


FIG. 3. PHASING TRANSFORMERS.

machine, because the inductance and the condenser previously described cut off the flow of the current before the machine has reached the zero point, and when the lead *r* is placed upon an iron core, as shown in Fig. 4, it has a tendency to lag, which counter-balances the lead and leaves the main line current somewhere near in phase with the electromotive force of the generator.

Please refer now to Fig. 4, where the leads *l* and *n* are wound in opposite directions, and completely interlaced upon the iron core *L*, the generator, inductance and capacity being indicated by the same symbols as in previous figures. The lead *r* is here wound upon the second iron core, which constitutes the primary of the simple section of the transformer as shown at *B*, Fig. 1. In reducing to practice and applying the transformer to an induction motor, we find that the inductance *E* can be dispensed with, as the apparent inductance produced by the motor furnishes all the lag necessary; and it will be noted that in Fig. 1 the extra inductance which we used in our first experiments is left out of the combination. The lead from the simple section of the transformer, it will be noted, goes to the center of the compound section. This diagram does not represent the true condition of the compound section, for the winding *n* and *l* are together, or, as before mentioned, interlaced upon the

1. Read at the meeting of the American Institute of Electrical Engineers, New York, September 25, 1895.

core. The magnetic flux in the two sections of the transformer are approximately 90 degrees apart. The secondaries are therefore wound each partially upon the two cores, so that the three resultant phases may be produced from two, this being in accordance with Fred. S. Hunting's invention for changing two phases to three. For the description of this I will quote Mr. Hunting's own words, and the plan is in Fig. 5:

"If $P^1$ and $P^2$ represent two primary circuits supplied respectively with alternating currents differing in phase, or disposed in any other suitable manner so that the fluctuating magnetic impulses developed in the cores $M^1$ and $M^2$ differ in time, then the secondary currents developed in circuits $S^1$ and $S^2$ will differ in time period. If other circuits, as $S^3$ and $S^4$, be so arranged that part of their convolutions will enclose one magnetic core and part another, there will be developed in these circuits a resultant current due to the combined action of both magnetic cores, and this current may be given any desired degree of phase displacement with reference to the current in primary coils $P^1$ and $P^2$, accordingly as the number of convolutions surrounding the respective cores is varied. For example, if, as shown in circuit $S^4$, an equal number of convolutions is placed around each core, then there will be developed in circuit $S^4$ a resultant current having its phase half way between the phase of current in coils $P^1$ and $P^2$. If the number of convolutions on the two cores vary in the proportion of three to two, and be joined together as indicated by the coils $S^3$, the resulting current produced by these coils will be closer in phase to the current flowing in $P^1$, providing the larger number of convolutions be placed as indicated in the diagram upon the magnetic core controlled by coil $P^1$. Thus, by varying the relative proportions of the two coils inclosing the two magnetic circuits, a resulting current of any desired phase displacement with reference to the phase of coils $P^1$ and $P^2$ may be developed. It will thus be seen that by means of two magnetic circuits or cores in which magneto-motive forces differing in phase are developed, we may produce any desired number of currents of differing phase, and may produce a definite degree of phase displacement, and the resultant current may in any case be shifted closer to the phase of magneto-motive force in either core, by increasing the inductive influence of said core upon the circuit carrying the resultant current.

"In the organization shown in the diagram, we will have four secondary currents developed from the primary coils $P^1$ and $P^2$, and assuming that the currents flowing through these coils differ in phase, all of said secondary currents will differ in phase."

Mr. Scott's invention for changing two phases to three may also be used, and is shown in Fig. 6. Making the resultants in this manner by means of the secondary windings contributes also to steadiness of phasing. If desired,

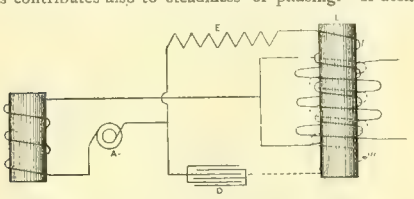


FIG. 4. PHASING TRANSFORMERS.

two secondaries having a proper two-phase relation may be used on the motor.

The experimental work, in which I have been greatly assisted by Messrs. Hulse and Chapman, has occupied a long time and has passed through a great many stages. The results represent a great deal of patience, and we have chased the phases from zero to 180 degrees, back and forth, until there is a well-worn path between these two points, but finally we have a set of beautiful results, and the electro-motive force curves will be found in Fig. 7, taken from the transformer, in connection with a half-horse power motor, running at full load, and Fig. 8 gives the current curves of the same. This motor gives powerful starting torque, and it gives me pleasure to show it to you here in operation. I want to bring to your attention one feature of the compound coil used in combination with the condenser, which will be found in Figs. 9 and 10. If we suppose a direction of motion as shown by the arrow and the current in the condenser branch leads by 90 degrees, which is represented at *b*, and the current in the inductance branch lags by 90 degrees as indicated at *c*, and the wires carrying these currents are wound in opposite directions upon the core, we will have a resultant current, which is represented by extension *d*. Increase of load changes the phase relation of the individual branches, but not the resultant secondary, and this is explained by reference to Fig. 10, where a 75 degree lead and a 75 degree lag are represented by the respective branches, and as the branches are wound in opposite directions, we find that when *b* is turned over, it becomes a lag of 105 degrees, and the resultant of 75 degrees and 105 degrees again produce 90 degrees lag, and the value again represented by the extension *d*, the value of the current is slightly less, but its resultant phase is the same as is represented in Fig. 9. This explains the steadiness of phasing which we are able to obtain. This may be explained by another method of diagraming, as is shown in Figs. 11 and 12, where curve *a* represents the fundamental current, curve *b*, Fig. 11, a lead of 90 degrees, curve *c* a lag of 90 degrees, and then *b*, being turned over, unites with *c* to produce the resultant *d*, which is 90 degrees in lag of fundamental curve *a*. Now, in referring to Fig. 12, where the fundamental current is again represented by *a*, curve *b* represents a lead of 75 degrees, and full line curve *c* represents a lag of 75 degrees; then, when curve *b* is turned over in the windings, as shown in the dotted line, the coils being wound upon the same core, the resultant effect is represented by the curve *d*, which is 90 degrees in phase from fundamental curve *a*. Thus we see by increase of load, which tends to decrease the lead of the condenser circuit, and also decreases the lag of inductance circuit, our resultant is still in the same phase relation to the fundamental current.

The power factor is found to be very good. The current in the main line, feeding the transformer varying from 10 degrees lead at full load, to 35 degrees lag at no load, and the motor at starting produces the same effect as when working at full load, so that we have very good phasing for starting and full load, as well as a good power factor, it being 82 per cent. even at light loads, and the probability is that we will have very much better results upon larger sized transformers.

The condenser in this combination fills two very important functions, first assists in the phasing, and second prevents the lag upon the line. This arrangement does not prevent the idle currents flowing in the motor circuits, and the secondaries of the phasing transformer, and we find in small motors with the high period of 140 cycles that the apparent energy in the motor circuits is sometimes 2½ times the apparent energy in the main line. The capacity of condenser for a one-half horse power motor when 1,000

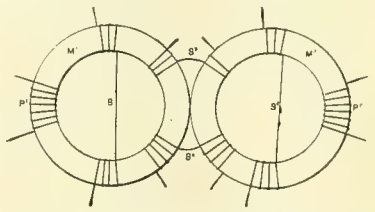


FIG. 5. PHASING TRANSFORMERS.

volts are supplied to the transformer is about 2.4 microfarads. Our condenser for this size, without connections, occupies a space of a cube four inches on each side, and capable of enduring 3,000 volts, or a factor of safety of four, as the voltage on the condenser is about 700. Of course it will be understood by those familiar with the designs of induction motors, that it is impossible to design a small motor with small power factor, as the air-gap necessary for mechanical construction has to be so large in proportion to the size of the motor.

Many attempts have been made by placing the condenser in direct connection with motors to produce rotary fields, but have so far been attended with little success; as the trade requires the motor to be of comparatively low voltage, which calls for a large capacity in the condenser, and as the output of the condenser of a given capacity is proportional to the square of the voltage, it will be seen how advantageous it is to place the condenser in combination with the primary of the step-down transformer.

It may seem trite to call your attention to the fact that the transformer reduces the voltage at the same time it does the phasing, but I think it is so important that I wish particularly to emphasize the fact. It is also of great importance that the device has no moving parts.

Upon reference to the cuts showing the curves obtained of the electromotive force and current, it will be readily seen that they are all of true sine form. The current for this work was obtained from a 75 kilowatt Slattery alternating machine. This machine has a surface winding on the armature, and, therefore, gives practically a sine wave. Just what the transformer may do on all the various dynamos that are in the market, giving all sorts of complex waves, is difficult to say, with our present experience, but, so far as we know now, the transformer tends to smooth out all the irregularities.

While the principal use for this device at present seems to be the application of polyphase motors to single-phase lighting systems, many new ones, undoubtedly, will be found. It may seem bold to think of applying this to long-distance trolley railroads, but I am hoping to have it done.

If the voltage is stepped down on the car or locomotive, it is just as economical to do it by the phasing transformer, with the exception of the added weight of condensers, which for a 1,200 horse power locomotive will be about two tons, and this is not of consequence on so large a power.

These condensers are very compact and efficient, and will stand from three to four times their working voltage, without puncturing the dielectric. I am sorry I cannot show you the condenser in all its details, but for certain reasons I cannot do so at present, but will present it to the Institute at the first opportunity.

A brief description of the motor may be in order, although it does not belong strictly to the subject. We met with much difficulty in developing a motor for so high a periodic-

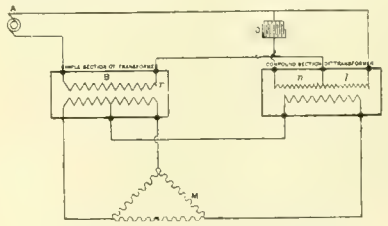


FIG. 6. PHASING TRANSFORMERS.

ity as 140 cycles. It is necessary to keep the density so low and it is always such a temptation to try to get all the power from a given piece of apparatus, that they are always heating much more than they should.

With a large number of poles and slots, we found that any use of wide bars in the armature was out of the question, for the eddying currents in the copper were too serious. We also looked for difficulties which we never found. At times we thought the heating was due to higher harmonics produced from the phasing transformer; but the fact is, we never found any, unless it was in the experiments upon the two-phase motor. As mentioned before, the waves are all of the true sine form.

Cuts of the motor are shown in Figs. 13 and 14, the rotary field being the exterior or stationary part, and the secondary or induced constituting the armature. The armature is composed of two sections, or practically two armatures end to end upon the same shaft, one of the armatures having a low resistance winding and the other a comparatively high resistance; the field is placed over a high resistance for starting, and shifted by means of a lever over the low resistance, when it has nearly attained speed. Of course this arrangement is for securing and starting up of the motor, and has nothing to do with the phasing transformer, and the motor might have rings for connecting the starting resistance to the armature and operate quite as well. The sliding of the field gave trouble, as the air-gap has to be small, and the play at the sides (noted 1*a* and 2*a*) allowed the armature to strike against the field, and when a tight fit was made, which would work easily when cold, it would stick fast when the motor rose in temperature; the writer therefore decided to give it quite a clearance at these points, and give it a guide at the bottom of the field shown at 3*a*. This being central and comparatively thin, the expansion is not sufficient to cause sticking, also the guides at 1*a* and 2*a*, being thin vertically, they may fit close, and still slide easily. The lever for moving crown back and forth is shown at 4*a*, Fig. 14, and 5*a*, Fig. 13. It fits loosely, having a fulcrum at 6*a*.

## Report on the Death of F. L. Pope.

Edward Weston, William Stanley and George A. Hamilton, after a thorough investigation into the causes of the death of Franklin Leonard Pope by electrical shock in the cellar of his home in Great Barrington, Mass., on October 13th, have prepared a long report which they intend to present to the American Institute of Electrical Engineers, of which Mr. Pope was past-president. The gentlemen named were intimate friends of the deceased engineer and were well acquainted with his character and his mode of working. They briefly describe the Great Barrington electric lighting plant, in which the alternating current system was employed, and mention the fact that a converter was located in the cellar of Mr. Pope's house. The primary wires leading to this converter carried current at a pressure of 2,000 volts, while the secondary house circuit, leading from it, was operated at 50 volts. The report continues:

Mr. Pope was a most careful and deliberate man, and was of course fully acquainted with the specific arrangement of all wires and apparatus installed in his cellar, and with the properties and action of the currents passing into and out of the apparatus; and the closest examination of every part of the apparatus and of the position and direction of the marks found on his body confirms this opinion of his character, and conclusively proves that he did not attempt to adjust

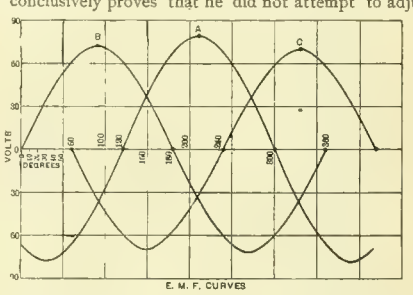



FIG. 7. PHASING TRANSFORMERS.

or remove any part of the apparatus and did not intentionally touch any part of it.

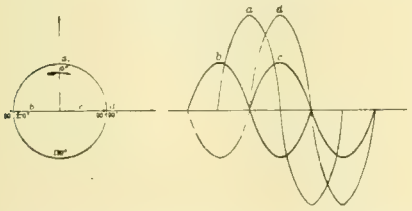
A few minutes before Mr. Pope went to examine the apparatus, his son turned on a lamp in the south parlor of the house and in doing so received a slight shock and informed his father of the fact. The light was so dim as to be of no service, and Mr. Pope's son wanted to go into the cellar to try to find the cause of the trouble. Mr. Pope refused to let him go and cautioned his son and all other members of the family not to touch any of the lamps or fixtures, at the same time stating that they might receive a severe shock if they did. It is certain, therefore, that Mr. Pope knew before he went into the cellar that there was something seriously wrong with the apparatus, and that it was dangerous to touch it. The mere knowledge of the fact that a shock could be obtained from the lamp fixture would at once convey to Mr. Pope's mind positive information that the circuit was grounded and that there must also be a leak or connection between the high and low pressure wires of the converters. * * * * *

The accident occurred in a small space in Mr. Pope's house which was partitioned off in the northeast corner of the main cellar. This space was but very dimly lighted at the time (about 5:20 P. M.) by very feeble daylight coming through a window 34 inches long by 13 inches wide. At the time Mr. Pope entered the cellar it was not so dark as to prevent a man seeing any large objects in the place, but there was not light enough to permit of a proper inspection of the smaller parts of the electrical apparatus, and probably not enough to enable him to see the wires leading into and out of it. When Mr. Pope went into the cellar he took with him a small kerosene lamp which was known to be lighted when he went down the cellar stairs. From all the conditions in the case it appears to be absolutely certain that it was some trouble with this kerosene lamp which was indirectly the cause of his death.

The two converters used for reducing the pressure of the 2,000 volts to 50 were fastened to pine boards which were attached to the side of a large chimney which was partly enclosed in the space partitioned off, and to the front of the chimney and very near the converter the supply meter was attached in the same way. This chimney and all the electrical apparatus was very close to the small window already referred to, the boards to which the converters were attached being only 28 inches from the end of the window frame and the faces of the converters were about 10 inches nearer the window. The wires carrying the 2,000 volt current from the street lines were brought into the cellar through the window opening, but in such manner as not to

nterfere with the free opening and closing of the window. The window was supported by a pair of hinges attached to the upper part of the window frame, very near the ceiling, so that it was in a pendant position and could swing very freely and easily, the long side of the window frame being parallel with the ceiling. Shortly after Mr. Pope left the south parlor, Miss Anna Pope was startled by the sound of a heavy fall and smashing glass. She secured a lamp at once and rushed down stairs and to the space in which the electric light apparatus was erected. Mr. Pope lay on the floor, breathing or gasping heavily. She immediately called her mother and then ran for medical aid. Two physicians (Dr. Large and Dr. Benjamin) live within 200 feet of Mr. Pope's house; one was in attendance within five minutes and the other within eight minutes after the accident. These gentlemen immediately resorted to the usual means of restoring respiration and they were soon aided in their efforts by Dr. Camp, who was also called, and all three did all that was possible to be done to revive Mr. Pope, but without avail.

Mr. Pope fell backward, and his body rested in a perfectly horizontal position, on his back, the bottom of his feet being 14 inches from the chimney wall, and the general direction of the body almost at right angles to it. His

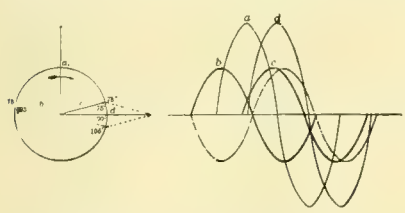


FIGS. 9 AND 11. PHASING TRANSFORMERS.

right foot was almost in a line with the side of the chimney to which the converters were attached. The lamp chimney was in fragments near his foot and the lamp was on the floor on the other side of his body at a point not very far from the left knee.

There were only three marks of injury due to the passage of the electric current found on Mr. Pope's body, all of which were found on the outer surfaces of the right hand. One of these marks is a nearly U-shaped curved line, its entire length not exceeding one inch, its width about three-sixteenths of an inch, and its depth about three thirty-seconds of an inch. The form of the curve was not quite as regular as the curve of the letter U. This mark is situated nearly at the top of the second thumb joint, but a little nearer the back of the hand than to the palm. Another and much larger mark is in the form of a nearly straight scar, three inches long and almost exactly the same width and depth as the curved mark on the upper part of the thumb joint. This long scar extends from the outer and upper palm or surface of the hand toward the back and wrist. The third mark is a very slight surface burn on the outer edge of the index finger, extending from about the quick of the nail to the first joint, but much nearer the back of the finger than to the inner surface. The inner surface of this finger and all other inner surfaces of the hand showed not the slightest trace of injury. All the surfaces of the hand which must of necessity have been brought into contact with the electrical apparatus if any attempt had been made to handle it or touch it for the purpose of investigation or adjustment are absolutely intact. It is certain, therefore, that Mr. Pope did not intentionally touch any part of the apparatus, and the fact that the marks on the hands are all on parts which are never used for the purposes of adjusting, feeling or investigating anything is positive proof that the fatal contact of the hand with the electrical apparatus was accidentally made.

The soles of his shoes were closely examined and a large number of small spots and several large ones were found in which the leather had been slightly burned or disintegrated by the current. These spots on the soles of his shoes and the marks on his right hand serve to conclusively prove that the circuit was completed through his feet and right hand, and taken alone they would establish the fact that



FIGS. 10 AND 12. PHASING TRANSFORMERS.

some part of the primary or 2,000 volt circuit was connected with the earth or grounded.

All parts of the electrical apparatus and the wires leading to it were most carefully examined with the hope of finding some mark or marks which would show the exact spot where the contact was made by his hand. No stains or marks could be found on any part of the converters or meter and none could be found on the secondary wires leading to the house supply wires. There was one suspicious looking and rather faint mark found on the insulation of one of the main wires leading to the primary or 2,000 volt circuit of the converter. This mark was very close to a joint in the wire; whether or not the stain on this wire was due to contact with the hand cannot be stated until after an examination under the microscope and other tests.

Not the slightest trace of any injury to the skin of any part of the feet could be found, notwithstanding the fact that the marks on the soles of the shoes demonstrate that the current passed through the feet. The absence of any marks on the feet is undoubtedly due to the fact that the shoes were damp or wet and in this condition they would distribute the charge over so large a surface that no burning or isintegration of the skin could possibly take place in so short a period of time as the contact was maintained.

The position of Mr. Pope's feet and the general direction of the body shows that he was very close to and facing the sides of the converters, and was also very close to the wires leading to and from them at the time of the accident. He must also have been within three or three and a half feet of the small window, which was not fastened, and which could and undoubtedly did swing inward with every moderate puff of wind striking it. On Saturday and Sunday, October 12th and 13th, it rained steadily, and the rain was accompanied by quite a strong but puffy wind from the northwest. The direction of the wind was therefore such as to cause it to strike the window with considerable force, the window facing almost directly north. It is believed that when Mr. Pope began to inspect the apparatus a puff of wind struck the window, and to protect the kerosene lamp in his left hand from being blown out, he suddenly raised his right hand to shield the top of the chimney, and in so doing accidentally struck the primary wire of the converters or some other part of the apparatus electrically connected with them, and practically received the full voltage of the main line circuit, having 2,000 volts. It is quite possible, however, that the lamp actually went out, and that in attempting to light a match he made a sweeping contact (such as would be necessary to produce the long scar) with the charged part of the apparatus. The position of the marks on the hand and the direction of the long scar tend rather to support the first view, and it is believed that the lamp chimney was knocked off by the sudden upward movement of his right hand and fell to the floor close to his right foot, while the lamp in his left hand was carried by him in his fall and fell to the left side of his body.

Accurate measurements have been made of the rooms and sketches and photographs were taken of the apparatus as it stood in its original position.

An examination of the wires leading from the main wires of the street into the cellar connected to the primary wires of the converters disclosed the existence of two grounds near the point of the entrance of the wire into the window opening.

The two converters were taken down and subjected to a series of tests to determine their condition. One of them was found to be perfectly insulated in all is parts and in perfect electrical condition, except that one of the secondary fuses was blown or melted. The other converter was in a badly damaged and dangerous condition, the primary circuit being broken and connected to the outer casing or cover, thus giving it a charge at least fully equal to the 2 000 volts on the street lines. On opening the case the insulator of the converter was found to be destroyed at a point near one end. The primary and secondary coils were also in electrical contact with each other. The damaged spot is also being photographed, and the converter will then be shipped to New York for further dissection and examination. The converter was made by one of the large electrical manufacturing companies, and the date of its construction and name of the party who wound or assembled it was found written in pencil on a piece of paper inside the case. The record reads as follows: "Sweitzer 4—3—90." This damaged converter was the one nearest to Mr. Pope when he received the shock. The cause of the damage to the injured converter cannot be ascertained until a full examination of all its parts is made.

The investigation discloses the fact that Mr. Pope met his death by reason of the existence of one or more grounds on the primary or main distributing lines of the system, and if this had not been the case he could not have received the fatal shock. The facts developed by the examination and study of the whole of the conditions in this case demonstrate:

First—That no matter how skilled a man may be or how much knowledge he may possess of the principles and mode of operation of electrical apparatus of this character, it is not safe to place converters inside of buildings without providing absolutely effective means of preventing access to them before the primary or main line current is turned off.

Second—No one should ever be permitted to handle or touch a converter, or the wires leading to and from it without first turning of the current from the primary or main line circuit.

Third—Effective indicating devices and alarms should be placed on the primary lighting wire circuits to call immediate attention to existence of grounds on the line, and when such an alarm or indication is given the location of the ground should at once be determined and the ground connection removed at once.

Fourth—Daily tests should be made of the condition of the lines to determine their approximate insulation resistance and records of such tests should be preserved from day to day so that any deterioration of the insulation resistance of the lines would be discovered,

Fifth—That all overhead high pressure lighting wires should be provided with guard wires situated above the lighting wires so as to prevent other wires from falling on and making contact with the lighting wires, and thus making grounds. If such guard wires be connected at intervals to the earth they will serve to protect the lighting wires to a large extent from the effects of lightning.

Sixth—That telegraph and telephone wires should always be placed below the lighting wires and should be so run as to prevent as far as possible interference with the lighting wires in case the telegraph or telephone wires break and fall.

The general public in considering this sad accident, must not lose sight of the fact that the conditions in this case are very peculiar. If the converters had not been placed inside Mr. Pope's house, or in some easily accessible position, or, indeed, if Mr. Pope had not had some trouble with the kerosene lamp, it is certain he would not have met his death by an electric shock. There is no need of unnecessary alarm or want of confidence in the safety of the electric light, and Mrs. Pope believes this so thoroughly and knows it so well that she immediately had a new converter erected on a pole outside the house and connected to the house supply wires by means of wires leading to the secondary coil, and is now again using electric lights in her home. In the loss of Mr. Pope the electrical profession has received a severe blow; and it has been deprived of a most worthy and able co-laborer and one who has added much to the advancement of the knowledge of the science of electricity and to the development of the electrical industries. He was a man of sterling character and added greatly to the luster of the body of faithful and earnest workers of which this country has the greatest reason to be proud.

## Institute Takes Action on the Death of F. L. Pope.

The regular monthly meeting of the American Institute of Electrical Engineers was held at 12 West Thirty-first street, New York city, October 23d. Vice-president

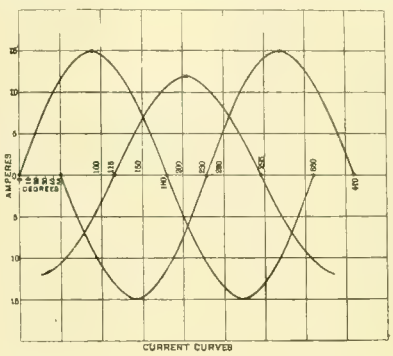



FIG. 8. PHASING TRANSFORMERS.

Crocker presided, and, after officially announcing the death of past-President Franklin Leonard Pope, stated that, by special request of President Duncan, Thomas D. Lockwood had prepared for presentation a set of resolutions. These resolutions, which were adopted, are as follows:

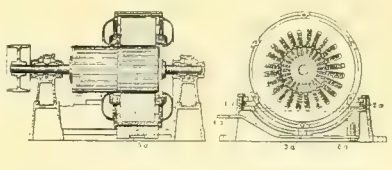
WHEREAS, The American Institute of Electrical Engineers has heard, with heartfelt sorrow, of the sudden death by a lamentable accident of its past president, Franklin Leonard Pope; and,

WHEREAS, We, the members, council and officers of the Institute, desire to express our profound realization of the bereavement we have sustained and the sincere grief we experience, and to record in fitting terms our keen appreciation of the great worth and high qualities of our late fellow member, his eminent services to our organization, and his able, unwearying and successful work in applying electrical energy to many useful purposes, it is therefore

*Resolved*, That by the death of Mr. Pope, called away in the full fruition of manhood and the meridian vigor of intellect, the profession at large has suffered an incalculable loss, and the Institute has been deprived of a most distinguished and valued member, and a wise and sagacious counselor, endeared to many members by long, pleasant and affectionate intercourse, and esteemed and respected by all, no less for his kindly and warm-hearted nature and dignified simplicity of character, than for his universally acknowledged genius and great ability.

*Resolved*, That we hereby express the poignant grief wherewith we contemplate the sad event which has taken from us one, who, whether in the earliest days of our association, co-operating in its successful establishment, urbanely and efficiently presiding as our chief executive officer at business and social meetings, discreetly and judiciously performing the unassuming duties of a member of the committee on editing or in the capacity of an individual member, conserving the interests of harmony and stability, has uniformly had the dignity of the Institute at heart, and has assiduously, cheerfully and faithfully labored for its welfare.

And while we sincerely mourn the loss of an associate



FIGS. 13 AND 14. PHASING TRANSFORMERS.

so eminent and useful, thus suddenly withdrawn from the activities of this present life, we most earnestly grieve for the parting from a friend so sincere, faithful and true.

*Resolved*, That we extend to his stricken family our tenderest sympathy in this the hour of their affliction, and that, in testimony thereof, a copy of these resolutions be forwarded to them.

*Resolved*, That these resolutions be appended to the minutes of the council and be published in the *Transactions* of the Institute.

The regular business of the evening was then taken up, a paper being read by Hermann Lemp of Lynn, on "Local Annealing of Hard Faced Armor Plates." This was followed by a paper on "The Rating and Behavior of Fuse Wires," by Prof. W. M. Stine, H. E. Gaytes and C. E. Freeman of Chicago. In the absence of the authors this paper was read by the secretary.

At the council meeting in the afternoon the following named associate members were elected: Harry Byrne, Chicago, Ill.; Edmund P. Coles, Schenectady, N. Y.; George W. Colles, Jr., Pittsburg, Pa.; L. G. Crawford, Chicago, Ill.; Harold W. Shonnard, New York city; Arthur F. Walker, Grand Rapids, Mich.

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IF the reports from Milwaukee concerning the street railway controversy are reliable, and there is no reason to doubt the veracity of all the writers on this subject, the old company would do well to make some pretense of satisfying public demands. Just now that corporation seems to be relying entirely upon its "pull" with the council. The aldermen have gotten over their indignation against Col. Payne and they are supposed to be ready to follow submissively any instructions they may be given. The great receiver is to be congratulated upon his success in taming them. Our correspondent who is in an excellent position to judge says that the Milwaukee colonel is bound to win.

OFFICIAL records show improvement in the condition of electrical business in Chicago. City Statistician Seeger has made a rough estimate of the advancement in business in the various industries of the city as compared with the corresponding period last year, the month of August having been selected upon which to base an estimate. In reply to the statistician's inquiries the firms and companies forwarded to him the information sought. Electrical concerns report a decided improvement, with an increase of 50 per cent. in the number of employes and an advance of 10 to 25 per cent. in the wages paid. It is remarked, too, that the feeling prevails in the trade that there will be a steady improvement, and that while no sudden rise of great magnitude is anticipated there is reason to believe that the growth will continue gradual and steady, and that the effect will be lasting.

AFTER several preliminary tests the official test of the plan for propelling canal boats by electricity was made at Tonawanda on Saturday, October 26th, in the presence of state officials, distinguished citizens from all parts of the state and representative boatmen. A report of this test is presented in this issue, and our correspondent announces that the state officials and experts present were very favorably impressed by the workings of the system. There has been no data presented showing the efficiency of the electrical apparatus, nor is there any other means at hand of making a comparison with the older methods which it is hoped to supplant. Of course the economy and efficiency of the proposed system will have much to do with its general adoption and until further particulars on these points are to be had there is no use considering the scheme as a practical measure. No doubt these will be forthcoming in due time. Their publication will be welcomed by all who are interested in the project.

SOME of the women living upon Indiana avenue, Chicago, are trying to prevent the substitution of an overhead trolley system for the horse car line at present in operation on that thoroughfare. They have held several meetings and have decided to engage in active warfare against the Chicago City Railway company. One of the leaders of the movement announced that the opposition was not only opposed to a trolley line but to any form of street railway upon that thoroughfare. The women interested have an idea that they can create the impression that Indiana avenue is a very exclusive residence street. As a matter of fact values on that thoroughfare have not advanced in keeping with those of other streets, and the chief reason is that the facilities for getting down town are very poor. It will be impossible to keep up any delusion much longer and progressive citizens are now realizing that the only hope of the district lies in securing improved street railway service. In the meantime the railway company is quietly awaiting the development of the idea. There is no doubt but that it is growing in favor.

STREET railway patents have caused so much trouble and annoyance that the operating companies have often considered the scheme of uniting for protection as now suggested by Messrs. Greene and McNamara in their report to the Montreal convention. The plan is given in detail in another column, and the arguments in its favor forcibly presented, but there are grave doubts of the practicability of the scheme, as the street railroad men heretofore have not evinced such a brotherly feeling as to warrant the assumption that they will take up the question in the spirit that will be required to make their action of any value. At conventions where their enthusiasm is aroused and kindly feeling is encouraged they look with favor on these plans, but as soon as they become immersed in the cares and toils of managing their respective properties they dismiss everything else from their minds. Something may possibly come of this plan if it is pushed vigorously and kept constantly before the men who are interested in it, for there is a possibility of effecting a considerable saving to operating companies. Many of the larger companies have thoroughly organized legal departments, well equipped, but they would welcome the relief that such a plan as that under consideration now promises.

UP in Wisconsin they are discussing the plans adopted by a couple who desired to get married but found it inconvenient to arrange a meeting for the purpose. The young lady lived at Oshkosh and of course wanted the ceremony performed there, but the young man, whose home was at St. Cloud, found that his duties as railroad agent would not permit him to leave his post, and there was no minister residing at that point. It was accordingly agreed to employ the telegraph in uniting the couple, and a clergyman was found at Oshkosh who agreed to perform the ceremony. It was then arranged that the usual questions would be asked the gentleman over the wire and his answer, made before witnesses, would be returned. The bride would, of course, reply to the minister in person. She would then take a "wedding tour" all alone to her husband's home. There seems to be no question in the minds of the contracting parties of the validity of the marriage ceremony thus conducted. Viewed as a purely civil contract, it is contended that there is no doubt of the binding force of such an agreement. In contracts made by telegraph the rule is that if a party makes an offer by telegraph, he authorizes a reply thereto by the same agency, thus constituting the telegraph company his agent for making the offer to the party to whom it is made and for receiving his reply, and the delivery of the reply telegram to the telegraph company for transmission to the offerer completes the contract. Of course in the case of a marriage contract it is to be hoped that there may never be any desire or reason for questioning the validity of the agreement.

NOW that M. Delahaye, and in his wake several other chemists, have decided that metallic sodium is formed by an electrolytic process in underground conduits, and that this, having a rare avidity for oxygen, bursts spontaneously into flame on slight provocation, and explodes the gas which is present, how are we to prevent a monthly or weekly recurrence of the blow-ups of which the city has already experienced so many? If as at present our underground conduits are ready to go off at every favorable opportunity, how can we tell, at the present rate of growth of the city and of commercial electrical underground work, how many hydrogen guns will be exploded per week in four or five years from now—say in the year 1900?

What is to be done to prevent the formation of sodium, when the ground is saturated on every commercial thoroughfare with sodium chloride, and on the streets, too, where the conduit is sure to be found? It is in these localities that most gas leaks are to be found, where there is the most tearing up and relaying of pavements and pipes, around every one of which there is a passage for escaping gas, into a conduit or into a cellar, or the reverse, with the very best of tamping and solidifying of the earth which has been replaced. And what is to be done if, as very many good people suppose, there is a more rapid wasting away of pipes now than there was a few years since, when there was no electric street railway system with a grounded terminal contact, which has been so many times pictured, with arrows enough for an Indian battle field, showing how the electricity skirmishes like a lost child, trying to get back to its mother; the strong current following water and gas pipes and digging like a wharf rat in its earnest homebound endeavors? Is there no chemistry which will thwart the incendiary attempts of this sodium? Cannot the disciples of Lussac and Thenard and Lavoisier fill our conduits with something to vitiate the electrolytic action which converts the sodium chloride into metallic sodium? Or failing of that, is there not a chemical union possible between carburetted hydrogen and some other gas with which these gentlemen are acquainted, to render it non-explosive and innocuous?

If we cannot prevent the cause, can we not have a cure for this growing evil?

JAPAN has done so much of late that we have come to look upon the inhabitants of that wonderful country as capable of far greater achievements. They are enterprising, ambitious, and intensely patriotic, and the resources of the country afford them ample opportunity for the exercise of their really remarkable ability. There is no longer reason to question their possesston of great industrial skill; they have already made marked advancement in the arts, and they have shown rare perception and discrimination. To-day they are reaching out in every direction, acquiring knowledge and securing training in the methods that obtain in more highly civilized countries. It is evident that they are rapidly assimilating the ideas and practices of the West. It is this feature that has led many to look upon them as possessing mimetic rather than inventive genius. Close observers have formed the opinion that while the faculty for imitation has been highly developed the greater powers for original thought and experiment have been lacking. But this is by no means established.

What mostly concerns the American merchant and manufacturer is the fact that under the new order that obtains in the Mikado's realm there is an excellent market opened for their wares and products. Japan desires to acquire all the benefits of modern civilization, and at present, at least, it finds it impossible to enjoy these without recourse to foreign countries.

In order to secure a reliable statement of the conditions of affairs as far as they relate to electrical progress in the Orient and the outlook for the introduction of American machinery and supplies, the WESTERN ELECTRICIAN made arrangements with William E. Curtis, lately returned from Japan, for an article on this subject. Mr. Curtis is a newspaper writer of national reputation, and during his sojourn among the subjects of the Mikado he was given exceptional opportunities of observing the advancement that was being made and of learning the policy of the government and the capitalists who are assisting in the development of the resources of the country. His views are presented on another page in this issue. It will be remarked that Mr. Curtis alludes to a noticeable increase in the demand for electrical supplies that has resulted in the establishment of a special business of furnishing articles of this kind, the same as in America and in European countries. The trait before mentioned of copying and reproducing the product of other countries is here remarked, and a personal experience related which indicates that the incandescent lighting business has already been invaded by these apt imitators. But this was to be expected.

However, it must be borne in mind that there are no facilities in Japan for making machinery and power generating apparatus on the scale that will be required in the development of the projects already contemplated, and in this line especially American manufacturers will find an excellent field. Already there are many representatives of American concerns on the ground, and they will doubtless encourage the development of the numerous electric power transmission schemes now under consideration. This of itself will open up a fine market, and it remains only for American enterprise to develop and take advantage of it.

## Electricity in Japan.

By William E. Curtis.

The use of electricity in Japan is almost as general as it is in the United States. There is no country where modern improvements are seized upon more eagerly, or are more popular among the people. While the Chinese, from the emperor himself down to the coolie who plows his rice paddy with a crooked stick, are fighting desperately to resist the introduction of modern ideas, Japan is searching all the corners of the earth for new processes and appliances that will increase her power of production and advance the comfort and welfare of her people.

In the suburbs of Kyoto, the western capital, is a marine railway about 1,000 yards long, which transfers through the rapids of a river the junks, sampans and cargo boats that furnish transportation for a large portion of the produce that comes into the city from the country northward. This enterprise is the result of a suggestion made in the graduating thesis of a student in a native school of engineering. For generations, indeed for centuries, the freight that followed this line of commerce was shifted by carts or on the backs of human beings between the upper and the lower levels of the stream, until that young man, who was born and had spent his life within sight of that river, having read of marine railways in some scientific publication, conceived the idea of applying the principle to the problem his ancestors had been unable to solve, and made his plan the basis of a school essay. The governor of the district, who presided at the graduating exercises, was so much impressed with the ingenuity and audacity of the suggestion that he employed him to carry it out. The rapids now furnish power for an electric plant which not only lifts and lowers the commerce of Kyoto through its own foaming waters, but lights the streets and buildings of the city, feeds the motors of the only electric railway in Japan and supplies several small factories. The present plant generates about 6,000 horse power, but the capacity of the rapids is many times that amount, and preparations are already being made to enlarge it to 15,000 horse power.

Osaka is the Chicago of Japan. It is situated about the center of the main island of the empire, and is the seat of the largest mechanical industries. Its people are famous for their enterprise and money-making faculties, and the population of the place has doubled within the last ten years. Fifteen years ago there was not a steam engine in Osaka. Now, from the tower in the old citadel, one can count more than 500 chimneys. It is here that the cotton industry has acquired its greatest development, there being 37 factories with more than 400,000 spindles already in operation, and several others are under construction, to be finished during the present year. Most of the machinery is driven by steam, but a company has recently been organized for the purpose of utilizing the water power of a neighboring province for the production of electricity. It is proposed to supply power to the factories of Osaka at the rate of 85 yen (about $42.50 in American gold) per horse power per year, and as the proposed plant will transmit a current equal to 15,000 horse power, it is estimated that the total revenue of the enterprise will be 1,275,000 yen. The estimated outlay will be 5,300,000 yen, which is equivalent to about $2,650,000 in our money. It is proposed to erect 100 miles of wire at an expense of 3,000,000 yen, and purchase a plant that will cost 2,300,000 yen. The annual cost of maintenance is estimated at 530, 000yen, which upon the estimated earnings, will leave a net profit of 745,000 yen, or 14 per cent. upon the capital. The engineers report that the expense of increasing the plant to a capacity of 30,000 horse power will be comparatively small, and it will be done as soon as the demand justifies it. So large a portion of the capital of this enterprise had been subscribed before I left Japan as to leave no doubt of its success, and as the people there are very prompt and energetic in all their undertakings we may expect to see the scheme in practical operation within the next year or two. I take these figures from the prospectus of the company.

There is an excellent quality of coal in Japan, but the supply is comparatively limited, and, assuming that the little island is to become one of the great workshops of the world, as the prophets predict, the government, with the same wisdom that has characterized its policy of developing industry since the reformation, is already discussing measures to encourage economy in consumption and furnish a substitute. An official commission of engineers was recently appointed to examine the available water supply within the limits of the empire. Their report is a curious and interesting document. It gives a complete review, illustrated by maps, drawings and photographs, of the streams of the country, and their capacity for mechanical power, and reminded the people of a fact that was familiar but had never been considered of economical value. Nearly all the mountains of Japan are extinct volcanoes, with enormous craters that have been filled with water since the primeval fires were quenched. These vast lakes, which are numerous, lie at altitudes varying from 4,000 to 9,000 feet, and are fed from subterranean sources as well as by the rainfall and the melting snows. The commission calculates that these natural reservoirs, probably inexhaustible, are capable of supplying all the power that Japan will ever need to carry on her mechanical industries, and has recommended that they be utilized for the generation of electricity.

I cite these facts to illustrate the broad and far-reaching scheme of industrial development that is now occupying the minds of the economists and the officials of Japan, because every one of them is based upon the presumption that the wheels of the future will be driven by electric currents.

The government is about to build an enormous iron and steel establishment for the purpose of furnishing construction material and supplies for its railways, navy yards, public buildings and other improvements. An appropriation of 6,000,000 yen, or $3,000,000, has already been made for the purpose, and a commission has been appointed to report a plan for the consideration of the next parliament, which meets in November. It is proposed to introduce in this plant the most improved machinery that the genius of the world can furnish, and in its contemplation electricity is also considered as the great motive power of the future.

Concessions for electric railways in nearly all the principal cities of the country have been obtained or applied for, including several lines to connect the principal commercial centers with the towns and cities in their neighborhood. The longest line proposed is from Kobe to Kyoto, a distance of nearly sixty miles. There is another between Tokio and Yokohama, a distance of 18 miles, with branches to seashore resorts and outlying towns, which will give the system a mileage four or five times as great. As I was leaving Japan the company which runs a horse railway from Kozu to Yumoto and Myanoshita, the Newport of Japan, a distance of about fifteen miles, was about to introduce electric motors, but had not yet decided whether to adopt the overhead trolley or underground wires. It was awaiting reports from engineers in the United States and Europe upon the comparative success of those systems.

The spirit of progress was never so marked as it is in Japan to-day, and within the next ten years there will be a general introduction of public improvements of all kinds. Electric railways thus far are rare; that in Kyoto is the only one I saw, or heard of, but you find the electric light and telephone everywhere. The Edison and Brush systems are most commonly used. In all of the cities of importance are shops devoted exclusively to electrical apparatus and supplies, and their common use is indicated by advertisements in the newspapers. Most of this material until recently was imported from the United States, but there are now several large manufacturing establishments at which clever imitations of American patents are turned out in large quantities. They sell much lower than the imported articles but do not equal them in quality.

A bit of personal experience will be interesting. The light furnished by a 10 candle burner in my room at the Imperial Hotel at Tokio was not sufficient to enable me to read or write with comfort, and I could not persuade the manager of the hotel to improve it. I therefore went to a dealer in electrical supplies upon the Ginza—the State street of the capital—and bought a 32 candle bulb, which I substituted for the old one. The improvement was very gratifying, and when I left Tokio for Yokohama I unscrewed the bulb, and took it in my trunk. As I was getting settled at the Grand Hotel, in the later city, I attempted unsuccessfully to attach my big burner to the chandelier, and had to send for an engineer to assist me. He explained the difficulty by saying that my bulb was an imitation of the Brush burner made in Japan from imported materials, and therefore would not fit the imported chandeliers. I paid 50 cents for it. He told me that the imported ones were worth $2.

There will be no great market in Japan for ordinary electrical supplies because the people will manufacture their own, but during the next few years there will be a very extensive demand for heavy machinery and apparatus to carry out the enterprises I have mentioned, and any manufacturer would not only be justified but gratified in sending over there a competent agent to investigate the situation, and inform himself thoroughly about the conditions of the market. Nearly all the large manufacturers of the United States are already represented by well established and responsible houses, and some of the larger companies have resident agents, but there is just now a very determined movement on the part of the native merchants of Japan to deal directly with manufacturers instead of through foreign middlemen as formerly. This is the result of a recent remarkable development of national pride since the Chinese war.

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The Mississippi river is being sounded at La Crosse, Wis., prior to making the cable which will be laid across the river there to connect La Crosse and Winona, Minn., by telephone.

## Pumpelly-Sorley Company Absorbed by the Electric Storage Battery Company.

Perhaps the most important electrical deal of the year, at least in Chicago, was brought to a conclusion on October 24th, when the Pumpelly-Sorley Storage Battery company was absorbed by the Electric Storage Battery company of Philadelphia, the consideration being about $100,000 in cash.

Negotiations tending to this consolidation have been in progress for the last six weeks, the Pumpelly company being represented by B. J. Arnold, its treasurer, who organized the company in April, 1893, and has acted as managing director since that time. W. W. Gibbs, president of the Electric Storage Battery company, after sending competent representatives to Chicago to examine into the business of the Pumpelly company, decided that the product it was manufacturing was of sufficient merit, and the number of contracts it had secured large enough, to make it a formidable competitor in the storage battery field, the Pumpelly company having recently secured large contracts to install batteries in conjunction with electric elevators, lighting plants and electric railways.

While the Electric Storage Battery company felt that it could stop the Pumpelly company manufacturing by injunction proceedings, claiming infringement under the Brush patents, it was decided that it was better policy to pay a fair price for the property and the good will of its officers than to open up the serious question of storage battery litigation, which had so long acted to the detriment of the storage battery business. Mr. Arnold went East at the request of the Electric Storage Battery company, the result of the visit being an arrangement satisfactory to the companies, which was ratified by the stockholders of each company, and the money paid and property transferred last week Thursday.

The absorption of all of the principal competing battery companies, and now that of the Pumpelly company, gives the Electric Storage Battery company a practical monopoly of the storage battery patents and business of the United States, and, having recently acquired the right to use the Tudor battery (which had made such a splendid record in Europe) in this country, it is in a position to manufacture and supply batteries of any particular design or type which seems to its engineers best suited for any case, retaining throughout the principles involved in the chloride cell.

The reputation of the Pumpelly-Sorley cell, invented by J. K. Pumpelly and Charles Sorley, and brought to its present state of perfection through the efforts of Mr. Arnold, had become well established, and the probability is that the purchasing company will manufacture this cell for portable work in the future.

The deal was managed throughout by Mr. Arnold for the Pumpelly company with great tact and skill, but with that scrupulous integrity which is his chief characteristic. The outcome is satisfactory to all concerned. Mr. Arnold is warmly congratulated, and he deserves all the good things said about him.

## Mr. Kohlsaat's Joke.

In one of Barrie's shorter novels, "A Tillyloss Scandal," the author describes in a very diverting manner the unusual train of events which resulted in making Tammas Haggart a humorist. Tammas admitted that in the non-humorous period of his life he did not consider himself more nicely put together than other men, but as the result of an extraordinary occurrence the unsuspected humor in him burst forth.

In much the same manner a similar transformation appears to have been wrought in Mr. Kohlsaat of the *Chicago Times-Herald* by the excitement of his "horseless carriage" contest. Mr. Kohlsaat was known as a shrewd and sagacious business man with journalistic ambitions, but it was not until he appointed John P. Barrett as one of the judges of his motocycle race that he blossomed forth as a genuine humorist. It is certainly a joke to name "Professor" Barrett as the associate of Gen. Wesley Merritt, commanding the Department of Missouri, U. S. A., and Henry Timken, one of the leading men in the carriage trade of the country.

Mr. Kohlsaat now surely ranks with Tammas Haggart as humorist.

## A Mysterious Incident.

In a brief obituary notice of F. L. Pope, the London *Electrical Engineer* says: "The late Frank Pope had endeared himself to many members of the profession on this side, and, as might be expected, to a far larger number on the other side. The time has not yet come—and will not for many years, if ever, come—when the writer can divulge a certain historic incident in which his late friend played a most prominent part. The incident carried alarm and dismay to certain patentees and financiers across the Atlantic, and rendered forever impossible any harmonious working between these people and the writer."

## Defense in the Berliner Infringement Suit.

[From the Boston correspondent of the WESTERN ELECTRICIAN.]

The defendants in the case of the American Bell Telephone company against the National Telephone Manufacturing company have filed an answer in the United States Circuit Court in Boston. The Bell company brought a bill in equity against the defendants, alleging that they are infringing upon the Berliner patent, covering the microphone or transmitter, and ask that they be enjoined by an injunction from further infringement. The famous patent in question, No. 463,569, was granted November 17, 1891. The answer of the manufacturing company and J. D. Leatherbee and Arthur F. Boardman, also named as defendants, is in substance as follows:

These defendants upon information and belief deny that said patent, No. 463,569, in said bill declared upon, is a good and valid patent, and allege that the same is wholly invalid.

First—By reason of the delay in the Patent Office in and about granting of the same, during which delay many rights accrued to the public in and about the invention alleged by said bill to be described and claimed in said letters patent, and during which several patents involving the alleged invention issued to said Berliner, which delay, these defendants allege, being in no respect their fault, constitutes no reason why they should be prejudiced by said delayed letters patent issued on an invention alleged in said bill to have been made in 1877—eighteen years ago—rather than the complainant, who was a party to such delays, if not actively or intentionally, at any rate in fact; that there is no reason why these defendants or the public should exclusively suffer for such delay, and the said applicant and his said assignees be in no degree prejudiced thereby; that if by reason of the fault of the law or of the Patent Office or of the applicant or those in his interest, or of all combined, such delay occurs in the Patent Office as in the case of the patent in said bill declared upon, so that in the meantime applicant fully publishes the invention and other inventors perfect the invention, then, whether said delay amounts to laches upon the part of the applicant or those in his interest, or amounts to only noncompliance with the principles upon which the patent law is founded, or to failure to conform to its established conditions precedent, the patent is invalid; and that the complainant has no equity to enjoin these defendants under said letters patent No. 463,569, but that the complainant is estopped to assert or to enforce such patent.

Second—Because the patent No. 463,569 in said bill declared upon, and especially the alleged broad claims thereof, are for the same subject matter, thing or invention as letters patent to said Berliner, No. 233,969, of November 2, 1880, and were, therefore, allowed and issued contrary to the statute in such case made and provided. These defendants allege that the structure of the apparatus is identically the same, and described to be the same, in both of said letters patent Nos. 463,569 and 233,969, and that the mode of operation of said apparatus is the same in each of said letters patent; and that the said two patents are for the same invention, and for use in the same art; and that the latter of the two, viz, said patent No. 463,569, declared upon in said bill, is void.

Third—Because the thing, apparatus or mechanism described and claimed therein was not a patentable invention or discovery, but an inoperative and worthless device, wholly failing in point of utility, and did not involve the exercise of invention and was not novel at the time of its alleged invention, and has never been of any utility or put to any use.

Fourth—Because the application made June 4, 1877, was not according to the statutes of the United States, and did not become in accordance therewith by the amendments up to and including July 27, 1877, and up to and including October 27, 1877, as an application for the constant-contact variable-pressure transmitter or microphone, or for an art, method or process for the transmission of speech; and no application for such transmitter, or such art or method was made until after the same had been in public use by the complainant and others more than two years; thereby said Berliner abandoned said alleged invention, if the same were ever made by him.

Fifth—Because the invention alleged in said bill to be described and claimed, in said patent is substantially other than and different from any indicated, suggested or described in alleged application therefore of June 4, 1877, or in the attempted amendments up to July 27, 1877, or up to August 8, 1877, or up to and including October 27, 1877, and if any application made after June 4, 1877, was for such alleged invention, the same dates from the filing thereof and not, as an allowable amendment, from said June 4, 1877, and is subject to all usual defenses thereby arising.

Sixth—Because said patent No. 463,569, so far as the same describes or broadly claims the constant contact variable-pressure transmitter, or microphone so-called, was justly obtained by the said Berliner, or his assigns, for that which was, in fact, the invention of Alexander G. Bell, then of Salem, Massachusetts, who was then using reasonable diligence in adapting and perfecting the same.

Seventh—Because said patent No. 463,569, so far as the same describes or broadly claims the constant-contact variable-pressure transmitter, or microphone so-called, was unjustly obtained by the said Berliner, or his assigns, for that which was, in fact, the invention of Thomas A. Edison, then of Menlo Park, N. J., now of Llewellyn Park, who was then using reasonable diligence in adapting and perfecting the same.

Eighth—Because said patent No. 463,569, so far as the same describes or broadly claims the constant-contact variable-pressure transmitter, or microphone so-called, was unjustly obtained by said Berliner, or his assigns, for that which was, in fact, the invention of Elisha Gray, of Chicago, Ill., who was then using reasonable diligence in adapting and perfecting the same.

Ninth—Because said patent No. 463,569 was unjustly obtained by said Berliner, or his assigns, for that which was, in fact, the invention of James W. McDonough of Chicago, Ill., who, was then using reasonable diligence in adapting and perfecting the same.

Tenth—Because said patent No. 463,569, was unjustly obtained by said Berliner, or his assigs, for that which was, in fact, the invention of William L. Voelker of Springfield township, Delaware county, Pa., who was then using reasonable diligence in adapting and perfecting the same.

Eleventh—Because the alleged invention, the constant-contact variable-pressure transmitter, or microphone, or substantial and material parts thereof, had been patented in the United States prior to said Berliner's invention or discovery thereof.

[Here the defendants cite in support of this contention a long list of patents issued to Thomas A. Edison and others.]

Fourteenth—Because for more than two years prior to any application under and according to the laws of the United States, by the said Berliner, or his assigns, for letters patent for the invention alleged in said bill to be described and claimed in said letters patent 463,569, the same, or material or substantial parts thereof, had been in public use in this country both by this complainant and their predecessors and assignors, and by said Berliner, at said Boston and elsewhere, and by Alexander Graham Bell, of Salem, at Salem, and Boston, and Washington, D. C., and by Thomas A. Edison, formerly of Menlo Park, now of Llewellyn Park, New Jersey, at said Menlo Park, and by Elisha Gray of Chicago, at said Chicago and elsewhere; and by various other persons whose names and residences are now unknown to these defendants, but which, when found, they ask leave to insert in this their answer.

And further answering, defendants allege on information and belief, that before the application of June 4, 1877, alleged in said bill to have been filed by said Berliner for said letters patent No. 463,569, the invention, machine or apparatus set forth in said application, had been published in the printed publications hereinbefore in paragraph eleventh set forth; and had been also in public use in Germany by Philip Reiss, G. Quinke of Heidelberg, Giesen; C. Bohm of Aschafenberg; Dr. R. Bottger, president of the Physical Society; Albert & Son, mechanics, Johann Ehren and Segismund Theodore Stein, of and at Frankfort-on-the-Main; Leon Garnier, Ernst Hockheimer, Rudolph Meissel, Heinrich Hold and Heinrich F. Peteur, at Freidrichsdorf; and in England by William Ladd of London; and at Dublin, Ireland, by Thomas Ballad of Bristol, England, Stephen M. Yates and A. M. Vereker of said Dublin; which said use had shown that the apparatus known and described, as foresaid, as the Reiss telephone, transmitted not only musical sounds, but to an extent articulate sounds and speech, which transmission defendants allege to have been in part and at times accomplished by varying the resistance in the circuit by varying the pressure of the electrodes, thereby weakening the current without breaking the circuit.

And further answering, defendants show unto your honors that the said Berliner, at the time of the alleged invention set forth in said bill, appears to have been an uninformed and tentative experimenter upon various theories, including those enunciated by the said Bell in his patent of 1876, but not then fully or generally understood, admitted or current even among scientific students, and does not appear by his said application or by his acts and writings to have appreciated the alleged necessity of constant contact between the electrodes, in order to embody Bell's method of transmitting articulate speech, until long after practical forms of constant-contact variable-pressure transmitters had been produced, that he naturally failed in his application of June 4, 1877, and in his attempted amendments up to and including October, 1877, to set forth or claim an invention which he does not appear to have then arrived at, to-wit, a constant-contact variable-resistance transmitter; that he had therefore, by his own admission, sought to protect himself by filing caveats for what are now considered opposite and inconsistent inventions, and after his caveat of April 14th, alleged in said bill to be for transmitter operating by weakening the current, but which he appears to have regarded as operating by make-and-break of circuit, he filed April 30, 1877, a caveat for an air-discharge instrument, and on May 9, 1877, a caveat for a distinctly make-and-break transmitter; that his application of June 4, 1877, was never made to state the necessity of constant variable-contact in conformity with the requirements of the patent law, and particularly U. S. R. S., § 4888, until after other inventors had produced commercial forms of constant-contact variable-resistance transmitters, or even until the same had been in public use for more than two years, as hereinbefore set forth, and that none of the apparatus produced by him has ever been of any practical use in telephony, nor the public his debtor for any advance in the art. The Blake form of carbon microphone was introduced commercially in the fall of 1878; the Edison carbon transmitters were in extensive public use in the summer of 1878, and were invented as early as April, 1877, and improved in July, 1877, as shown in applications for said Edison patents Nos. 474,230 and 474,231. And long before that substantially the same structure as that described in said Berliner letters patent No. 463,569—a simple structure, as defendants believe—had been made and operated as a musical telephone and for other electrical uses, by various persons hereinbefore named.

In view of these facts and circumstances, and of the history and state of the art, these defendants, upon information and belief, further say that the said Emile Berliner was not the inventor of any practically useful or commercial microphone, or constant-pressure variable-contact transmitter as alleged in said bill or as described and claimed in said letters patent No. 463,569, but that the same was the product of the state of the art in 1876, the invention of A. G. Bell, set forth in his letters patent of 1876, and as hereinbefore mentioned, the invention of Elisha Gray and others hereinbefore set forth, supplemented by the inventions of Thomas A. Edison, upon some of which he applied for patents in April and July, 1877, as shown in U. S. letters patent to said Edison, Nos. 474,230 and 474,231, and hereinbefore set forth, and so far as improved by other and later inventors than said Bell and said Edison and others aforesaid, the valuable features of such variable-contact transmitter were largely devised by Blake, Hunning and others mentioned in complainant's bill, and are described in various patents and publications now constituting the exposition of the art of electrically transmitting speech as practiced at the present time.

That in view of the history and state of the art, and of said references, the letters patent No. 463,569, declared on or in said bill, are not valid as a patent for an art, method or process, nor as a broad patent for the machine known as a constant-contact variable-pressure transmitter, but if valid at all only as a patent for precise forms or details of structure merely, or narrow and limited scope.

And further answering, defendants say on information and belief that the invention and improvements alleged in said bill to be described and claimed in said letters patent No. 463,569, were patented to the said Emile Berliner, or to those in his interest, in foreign countries before the same were patented in the United States, and that patents therefore so granted in such foreign countries have expired, and that by force of the statutes of the United States in such case made and provided, the said letters patent No. 463,569 have expired and become void and of no effect, and that complainant is not entitled to any relief in equity thereon; that said foreign patents to said Berliner are: Letters patent of France No. 134,481, of January 8, 1880; letters patent of Canada No. 11,734 to said Berliner and one Williams, of September 8, 1880, and others the countries, dates and numbers whereof are not now known to defendants, but which, when found, they crave leave to insert in this, their answer.

And further answering, these defendants say on information and belief that said letters patent No. 463,569 do not describe or claim the herein mentioned telephone transmitters made and sold by defendant; and that they have not infringed said letters patent No. 463,569, or any of the claims thereof, if, as they deny as foresaid, the same or any of the same are of any validity; that the transmitters by them, or any of them, made, used or sold, as hereinbefore set forth, are not infringments thereof, in whole or in any part, but were made under and according to letters patent of the United States No. 530,575, of December 11, 1894, to A. F. Boardman and used in connection with receivers made under and according to letters patent of the United States No. 520,406, of May 29, 1894, to said Boardman, and with telephone switch apparatus made under and according to letters patent of the United States No. 545,191, of August 27, 1895, to said Boardman; all said telephonic apparatus being utilized in a novel system of combination telephone sets, for both long and short distances, made possible by inventions and improvements in switchboards, and in systems of wiring whereon application has been or is about to be made for letters patent, and by which a considerable part of the original cost of a telephone plant is saved; and they deny that complainant is entitled in equity to enjoin the use of said transmitters, or to prevent or postpone the public benefits of the use thereof as aforesaid.

And these respondents, further answering, deny each and every allegation of complainant's bill of complaint, except such as are hereinbefore admitted true and such as are hereinbefore declared not within the knowledge of these respondents, of all which the call for proof is material.

And these respondents pray the same benefit of the facts and things herein set forth as if for the reason thereof they had demurred when the same would have been proper, or as if they had especially pleaded to said bill when a special plea would have been proper. And further, these respondents are advised that it is not now material or proper for them to answer said bill.

Wherefore, these respondents submit that the complainant is not entitled to the relief or any part thereof prayed for in said bill of complaint, without this, that any other matter in said bill of complaint contained material to be answered unto, confessed and avoided, traversed or denied, is true.

All which matters and things these respondents are ready to maintain, aver and prove, as this honorable court shall direct, and pray to be hence dismissed, with their reasonable costs and charges, in their behalf most wrongfully sustained.

## Another Chicago Park Lighting Plant.

An important addition to Chicago's electric lighting plants will soon be made, as the finance-improvement committee of the West Park Board has engaged the services of an electrical engineer to prepare plans for a system of arc lighting for the parks and boulevards on the West Side. The idea is to have one central plant at which sufficient power may be generated to light the entire system of parks and boulevards, the wires to be carried through conduits.

Foree Bain, the well-known Chicago electrical expert, has been selected as engineer to design, purchase and install the plant. The installation will consist of 1,000 horse power boiler capacity, two 500 horse power compound condensing Corliss engines, a six-inch jack shaft, with automatic oilers, necessary clutches and pulleys, and eleven 100 light arc dynamos. There will be one thousand 2,000 candle power arc lamps installed. These lamps will hang from newly designed park poles. The wires will all be placed underground. There will be required for the plant about 100 miles of underground lead-covered cable, No. 5. When finished the plant will be a model. It is Mr. Bain's design to construct the plant with a view to the lowest possible cost of operation. The work of placing the conduit will be begun at once. Apparatus will probably not be required before the first of the year. Mr. Bain is now drawing specifications with a view to submitting them for the purpose of receiving propositions for the apparatus required.

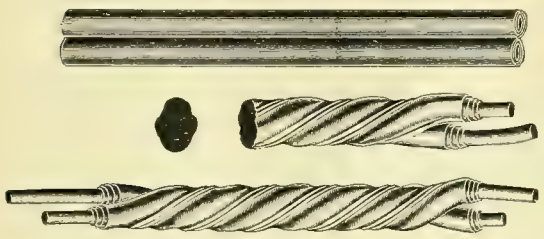
Commissioner Moll says that Garfield Park has been partially agreed upon as the proper location for the plant, provided it has the approval of the engineer who is making the surveys and estimates. The commissioners have widely different views as to the probable cost of the enterprise, some of them putting it as low as $50,000, while Commissioner Graham thinks the board will hardly be able to get what it wants under an expenditure of $200,000. About 500 lights are to be placed in Douglas and Humboldt parks and about 25 miles of boulevard are to be lighted. Commissioner Moll said that far so as the board's experience in electric lighting had shown, it would cost about $100 a light to establish the plant.

The South Park Board has a large Brush high-tension plant in Washington Park that has been in operation three years, and the electric lighting has been found to be a great improvement.

Lincoln Park, the favorite North Side resort, has also a plant for furnishing current to the arc lamps which illuminate the drives and walks of that beautiful pleasure ground. This is a pretentious equipment, and a feature of the installation is the artistic effect produced by the electric lights about the lagoons and boathouses. This park also possesses the Yerkes electric fountain, which serves to attract many thousands of visitors every summer.

## Novel Wire Joint.

Electric linemen, wiremen, and telephone and telegraph linemen especially, will be interested to know something of what is claimed to be the cheapest wire joint in the market —and it certainly seems as though there was reason in the claim made by its manufacturer. The American Electric Fuse company of 87–89 Washington street, Chicago, is now putting on the market the American connector, illustrated in the accompanying cut. This connector is designed for an

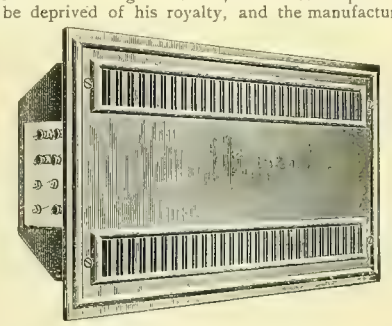


NOVEL WIRE JOINT.

absolutely air-tight joint formed without heat or solder. Its manufacturers claim that it is the only connector on the market that can be made air-tight without heat or solder. A glance at the three views shown in the accompanying cut shows first the connector after it has been formed by machinery ready for shipment, next a section of a joint, while the last illustrates a complete joint that has been formed with the aid of this connector. It will be seen that the American cannector is made of two rolls of sheet copper, not tubing, the sheet copper being rolled by a specially designed machine into shape as shown in the top cut of the three. To make a joint with this connector the wires are inserted one in each of the rollers as indicated, and the twist is made by means of two special twisting tools that leave a peculiarly solid joint.

## New Electric Car Heater.

The Interior Conduit & Insulation company of New York has introduced this season the electric car heater shown in the cut, which is believed to embody great improvements in this class of apparatus. A very high efficiency has been obtained in these appliances, and this economy of operation is by far the most important factor which is considered by any railway company. All the electric energy absorbed by any electric heater is converted into heat, and it has in consequence been assumed by many that electric heaters are of necessity of equal efficiency, but this is not the case. It is not sufficient merely to create heat, but also to utilize it to the best advantage, and in order to do this it is imperative that the heat should be distributed and circulated where it is needed and as fast as it is generated. In many heaters a large proportion of the heat produced has been non-effective for any useful purpose owing to lack of proper distribution, as most of the air current passes around the coils, leaving the heat dormant, and the cases of such heaters absorb a large quantity of heat, so much so that in some instances fire has been caused, endangering the lives of passengers. Such heaters require from six to 12 amperes at 500 volts to sufficiently warm the car. In the heater manufactured by the Interior Conduit & Insulation company a continual circulation of air is maintained. All the air passes through the coils, and all the heat generated is carried off and distributed into the body of the car, the case of the heater remaining perfectly cool. There is absolutely no waste, and consequently a much higher degree of efficiency is obtained than has hitherto, been practicable. These heaters are thoroughly well made, neat in appearance, easily installed, and are amply guaranteed.



NEW ELECTRIC CAR HEATER.

## Street Railway Patents.[1]

By F. R. Greene and J. W. McNamara.

The majority of street railways have, at one time or another in their history, been sued for using or making some device which was an alleged infringement on some patent. These cases were either fought out in the courts or settled by the railway company rather than go to the expense of court costs and attorneys' fees. A large proportion of railways have paid and are now paying royalties, either directly to the patentee or indirectly to the manufacturer (the royalty in the latter case being included in the price of the article paid by the purchaser) on certain articles in use on their systems. These direct royalties are often paid when exacted to avoid going to the expense of hiring an attorney to look up the patent papers to see if the claimant has a good patent and a valid claim to his royalty. The expense of investigating such matters is often more than the amount involved, hence the matter is settled upon the payment of a few hundred dollars. The manufacturer should stand the burden of infringement suits and not the purchaser, and the advantage of an association of this kind would be to influence or compel the claimant to direct his suits against the manufacturer and not the railways. Since the adoption of electricity as a motive power we find that the number of patented articles in use on street railways has increased wonderfully. We are confident that a large number of these patents are worthless and will not "hold water."

Were these alleged patents to be investigated a great number would become common property on account of the patent feature becoming eliminated, and hence the patentee would be deprived of his royalty, and the manufacturer would at once reduce his price in consequence. We do not mean to say that the honest inventor is not entitled to his royalty, provided he has a good bona fide invention. It is clearly evident that if the street railway companies were combined together in an association of this character that the expense to each would be small, while the advantages would be manifold. Another important item will be the assistance of the association in advising its members concerning new inventions of their own employes, whether the articles are patentable or whether infringements on other inventions; the assistance to be furnished free to the railway companies which are members of the association. This will serve to encourage employes to work out improvements in devices in use on street railways and protect them in their rights. The advantage to the company presenting such new invention will be that they will be permitted to use the device free of royalty.

A great many devices in use on our system are common property at the present time, from the fact that the patent has expired, yet how many members of this association know the expiration of the patent limit on a single device in use on their roads, and in ignorance of such facts are still paying the same old price.

The idea of such an organization of this kind was prompted by the fact that two similar ones have been in existence for over 24 years for the benefit of the steam railroads, and have been highly successful in every detail. One of these associations is located in the East and the other is located at Chicago, and the two include as members all the important railroads in the country and a large number of the smaller roads.

The object of the Western Railroad association, as stated in its by-laws, is as follows: "The object of this association is the investigation of all patents and improvements affecting the interests of railroad companies, members hereof, and their mutual protection against the unjust and unreasonable claims and demands of patentees and their representatives, and the procuring of other information which may appear to be of value to the association."

We have had several conferences with the general counsel of this association, and he has been very kind in giving us information regarding the workings of his association. He also declared that an association of like nature for street railways will be highly beneficial to all concerned, and recommended it.

This association is maintained by an annual assessment of its members, based on the gross earnings of the several railroads, payable in quarterly installments. The expenses of the association consist of the salary of an attorney, office help, rent, traveling expenses, court expenses, patent office books, pamphlets, etc., and is conducted on a more expensive scale than would be necessary in a like organization for street railways. For instance, in the beginning our association might not feel like hiring an attorney to give his entire time, but only pay him for actual work on fixed rates. The expenses for the first year would, of course, be larger in proportion than the following.

The Western Railroad association has won about four-fifths of its suits, and stands all expenses connected with the suits, but does not, of course, pay any judgments; the defendant road paying any judgment that may be entered. The entire membership, however, obtains the benefit of all such trials. The work performed by the Western Railroad association in 1894, if done thr ugh the regular channels by the roads themselves, would have cost about ten times as much as was paid to the association during the year for the same. It is the practice of the roads belonging to the association not to put on any new device without first referring the same to the association for advice. The number of suits against the railroads has been reduced very materially since this association was started, and $60,000,000 in judgments were defeated in one year. One of the large trunk lines paid $10,000 for using a patented article that was afterward found to be worthless as far as the patent feature was concerned. Since then it refers all such matters to the Western Railroad association before adopting devices or settling claims of this character.

A certain street railway, so we are informed, paid $1,500 to prevent suit on an alleged infringement, and the patent was worthless, as was afterward learned; this might have been saved if an organization of this kind was in existence.

One of the roads represented at this convention is negotiating at the present time with two different firms on matters that could be properly referred to an association of this character. One of the articles in question is used by all electric railways in large quantities, and the inventor is receiving large royalties from the manufacturer. A patent attorney informed the road that he thought the patent worthless, but it would take a lawsuit to convince the manufacturer. If this be true this road would have saved $10,000 to $15,000 by having this matter investigated at the start, saying nothing about what others would have saved that are using this article to-day and are paying the manufacturer whatever he chooses to ask.

The other device referred to can be manufactured by the companies themselves, which is also true of the former article, and has recently come into use and is being used by several companies in large quantities. The patentee is willing that the street car companies should manufacture the devices themselves, providing they will pay him a large sum of money for the privilege of so doing, the company already having paid him many thousands of dollars for furnishing the article up to this time. We understand that a similar device has been used by another manufacturer in the past, though for some reason it was not patented. This being true the patent is worthless, and his demand for royalty would fall flat were the same taken to the courts for settlement. These two matters are still unsettled and are very important to the roads in question, as well as to others who are members of this association and are using the same device.

Another road a few years ago paid over $1,000 in royalties on a truck that was invented by a former employe while working for the road, simply to prevent a lawsuit, as it would cost more than this amount to have defended the suit.

Another important feature in this connection would be the collecting of different patented devices in use on our system, the same to be preserved and open to the inspection at all times of the members of the association. In short, we might sum up the most important points as follows:

1. Lessening total expenses in fighting patent suits, etc., as a suit affecting one road would affect all.
2. Uniformity of action.
3. Additional safety in putting on new devices.
4. Greater facility in defending suits. etc.
5. Decrease in number of suits and claims on account of the existence of such an association.
6. Advantage in settling suits.
7. Contesting and avoiding unfair and unjust royalties.
8. Reduction of prices on all patented articles.
9. By members refusing to buy articles where suits are brought against any of its members, thus shifting suits to the manufacturer.
10. The dissemination of valuable information to its members of all matters relative to any suit, etc., in which one or more members are the interested parties.
11. Advantage of employes of street railway companies in getting valuable information and assistance on their own inventions, whether patentable or infringement of other devices, without additional cost to said railway or employe.
12. The acquiring of a full and authentic report of all devices that are commonly found in use on all street railways, such as fare registers, brakes, rail bonds and numerous other articles, giving the expiration of all such patents, opinion on the validity of the same, etc., and to be followed up by like reports from time to time, giving list and opinion of new patents, and list of expired patents.
13. The acquiring of models, devices, etc., for permanent exhibition.

In conclusion, your committee desires to suggest two plans of carrying into effect the scheme mentioned and recommends that the association adopt one of the following methods:

1. Provided the members vote to increase the scope of the association, we recommend that a bureau be established to handle all matters pertaining to patents as outlined in this report.

2. Provided it is not deemed best to enlarge the scope of the association at this time, we recommend that the association pass a resolution providing: That the annual dues be divided into two classes, regular and special (or

1. Report of committee presented at the convention of the American Street Railway association, Montreal, Que., October, 1895.

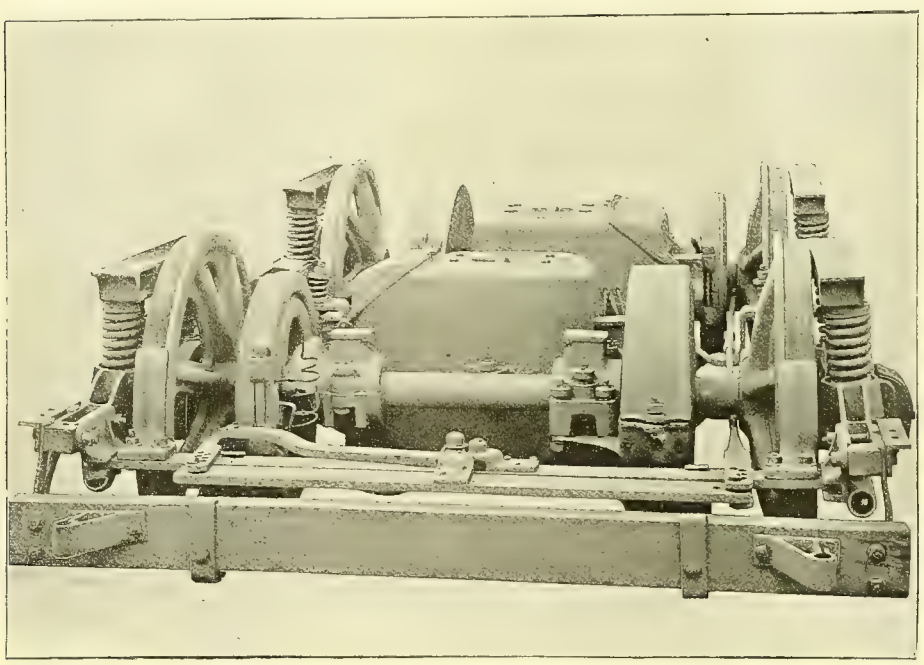
if necessary the by-laws be amended to that effect). That all members be required to pay the regular dues as already provided in the by-laws, and that it be optional with the members to pay the additional or special dues. That members paying special dues will be entitled to all the benefits to be derived through the agency of a patent bureau to be established under the direct control of the American Street Railway association. That the special dues be based upon the gross earnings of the several roads. That the association elect a board of control consisting of three members, whose terms shall expire in one, two and three years respectively, and hereafter electing one member each year, the board of control to establish and carry on a patent bureau as outlined in this paper, with the funds paid into the American Street Railway association as "special dues;" provided further that no street railway company be entitled to the benefits and privileges of the patent bureau except it is a regular member of the American Street Railway association.

## Electric Brake for Street Railway Service.

A new device shown at the Montreal convention was the electric brake developed by the General Electric company and shown in service in connection with two G E 800 motors. This brake has been developed to perform all the duties of mechanical brakes without their complications and faults. It operates equally well whether the trolley is on or off—in fact, the braking power is not derived from the central station, but is produced by the moving power itself.

The controller not only regulates the motors, but at the same time operates the brake, starting, accelerating, retarding and braking the car. When making a stop the controller handle is sharply thrown from running to braking position—and electricity does the rest. The operations are the conversion of the motors into special dynamos for generating current at very low speeds, the cutting of all connection with the trolley current and the application of the brakes. The rheostats and contacts used to control the motors in running the car also control the current generated by the motors and needed to apply the brake. The braking action is two fold and especially efficient. The rotating armature of the motor, instead of tugging ahead with its fly-wheel action by its momentum, is itself pulling back and more or less powerfully braking the car through the gears by the retarding effort of its magnetic field while generating the braking current. The power, therefore, required to perform this work is taken from the energy of the moving car. Not only is the car thus retarded, but the brakes arrest the motion of the wheels direct with a powerful force under perfect control of the motorman. No new or strange device is introduced to the motorman, the combined electric brake and series parallel controller is only the K2 controller writ slightly larger. The brake mechanism is readily attached to the motor and axles. It consists of a cast-iron disk keyed to each axle and a compact electro-magnet facing each disk and attached to the motor frame, preventing it from revolving by suitable lugs. The maximum current in the brake circuit is regulated by a limit switch adjusted to limit the current automatically to an amount just under the slipping point of the wheels. Independently of this switch, the brake pressure can be graduated by the controller handle, and a smooth, even motion secured on descending long grades. The disk and shoe are lubricated by a graphite brush carried in the shoe and pressing against the brake disk. This prevents excessive wear from friction and reduces the resistance between the shoe and disk—an important feature, as the eddy currents set up in the brake and shoe are even more effective in stopping the car than the simple friction between the shoe and disk. The two sets of brake magnets are in series, securing the same retarding effect on both axles.

The brake can be applied to any axle without removing the wheels, and the wear and tear does not come upon the tread of the wheel.



ELECTRIC BRAKE FOR STREET RAILWAY SERVICE.

# CORRESPONDENCE.

## New York Notes.

NEW YORK, October 26.—The Rapid Transit commissioners' tunnel road now appears to have good prospects of speedy construction, as the Court of Appeals has upheld Attorney Shepard's contention in relation to the board's application regarding the consent of property holders. The Rapid Transit commissioners laid out a route, but did not get the consent of the property owners to the construction of the road. Application was made by Mr. Shepard, as counsel for the Rapid Transit commissioners, to the Supreme Court, as provided by the constitution, for the designation of newspapers in which to publish notices of the intention of the commission to apply to the court for the appointment of three commissioners to report as to whether a railroad ought to be constructed or not. If the court approved the report of the commissioners when appointed, such approval was to operate in lieu of the consents of the property owners. The lower courts held that such application should be made to the Appellate Division of the Supreme Court which was established by the new constitution, and that the General Term had no power to consider it. All of the judges of the Court of Appeals concur in an opinion that the Appellate Division of the Supreme Court does not begin to exercise any powers until January 1st next, and that the new constitution does not abridge any of the powers and authority of the General Term. The court, therefore, reverses the order of the General Term and remits the proceedings to that court, in order that the application may be acted upon on its merits. William Steinway says: "Now we are in a position to push the underground project rapidly. Counsel will be instructed to make application at once to the General Term. The papers are all ready, of course, and the special commission of three may be appointed immediately. Of course, that commission, which has 30 days, if I am not mistaken, in which to hear and determine on the application, will report favorably on the application, as the city of New York has voted overwhelmingly in favor of the proposed underground road. The General Term will, we believe, at once confirm the report, and, as we will have our plans all completed, and as the city is authorized to bond itself for $50,000,000 for building the road, there is no reason why the underground road should not be begun within a few months. It certainly seems to me that rapid transit for this great city is now plainly in sight."

W. F. O.

# PERSONAL.

Wm. J. Hammer, the well-known electrical engineer of New York, is in Chicago.

L. H. Rogers, general manager of the Adams-Bagnall Electric company, Cleveland, was in Chicago last week in the interest of his company.

Henry C. Thompson, representing the Electric Gas Lighting company of Boston, was in Chicago last week. Mr. Thompson has been making a trip through the middle and western states in the interest of his company.

Elbert C. Ferguson, of the Chicago law firm of Ferguson & Goodnow, well known to the electrical fraternity, read a brief but carefully prepared paper on "Diversity of Commercial Laws and the Remedy" at the recent commercial law convention in Detroit. The address has been preserved in pamphlet form.

Prof. D. W. Shea, who has been the head of the College of Electrical Engineering at the Illinois State University at Champaign, Ill., for the last three years, has resigned to accept the chair of physics in the Catholic University of America at Washington, where he will be at the head of the department of physical sciences and is expected to establish a college of electrical engineering. Prof. Shea will leave for Washington as soon as arrangements can be made for carrying on the work of his department in Champaign.

Gen. Thomas T. Eckert, president of the Western Union Telegraph company, with Mrs. Eckert and Col. and Mrs. Robert C. Clowry, arrived in Chicago on Monday in the special car "Electric" over the Rock Island road from Denver. They were returning from an extended pleasure trip through the Northwest and Colorado, including Pike's Peak. Gen. and Mrs. Eckert were the guests of Mr. and Mrs. Clowry in Chicago. They left the city in the evening in their special car for Lexington, Ky., where Gen. Eckert owns a stock farm.

Chas. W. Price, editor of the *Electrical Review* of New York, who acted for the committee as master of ceremonies upon the special train from New York to the street railway convention at Montreal and return, has a beautiful reminder of the trip in the shape of a testimonial of thanks presented by the 100 passengers upon this trip. It is made of sealskin, lined with cream satin, the pages of which are elaborately engrossed in a most artistic manner, containing the formal testimonial of good fellowship and appreciation of the efforts that Mr. Price put forth for the enjoyment of the occasion.

W. J. Carruthers-Wain and Mrs. Carruthers-Wain are in Chicago. Mr. Carruthers-Wain is president of the United Tramways Institute of Great Britain. He and his wife attended the recent Montreal convention, and are in Chicago to inspect the cable and electric street railways. From this city they will go to Pittsburg, and thence to Boston and New York. Mr. Carruthers-Wain is a progressive street railway man and a thorough-going advocate of electric traction. He has had much to do with the electric railways already built in the United Kingdom, and is hopeful of great advances in the future.

The death is announced of Eugene Langen, one of the noted millionaires of Cologne, and one of the directors of the Otto Gas Engine Works of Philadelphia, on October 2d, at his country seat, Elsdorf, near Cologne. Mr Langen was one of the largest beet sugar manufacturers in the world, acquiring by that business about $20,000,000 in American money. He had beside a large business, and was a director of the Gas Motoren Fabrik Deutz, the largest of its kind in Germany. He had many decorations conferred upon him, one by the Emperor William I. for his ingenuity and enterprise. He visited the United States only once, in 1894, when the firm of Schleicher, Schumm & Co. ceased to exist, and the Otto Gas Engine Works were incorporated. The deceased was about 60 years old. He leaves a family of twelve children, one of whom, Gustave Langen, is the president of the American company.

# ELECTRIC LIGHTING.

The city of Madison, Ind., desires to sell or lease its electric light plant to someone who will build and operate about three miles of electric street railway, to be operated from the lighting plant. Ellison D. McGuire is mayor and will respond to inquiries.

The *China Gazette*, in a recent issue, speaking of the growth of electric lighting in Shanghai, says: "A couple of years ago there were only about seven miles of streets lighted by electricity, for which 60 arc lamps were quite sufficient, and there was not a single incandescent lamp in or around Shanghai. Now the electrical department of the Municipal Council runs 140 arc lamps, lighting some 15 miles of streets, and there are about 43 miles of line wire laid, in addition to 6,100 incandescent lamps of eight candle power each for domestic purposes. The customers for incandescent lighting have increased from one to 55 in number since the council took over charge of the department."

# TRADE NEWS.

A useful little catalogue is that issued by Roth Brothers & Co. of 30 Market street, Chicago. The firm manufactures high-grade dynamos and motors and has built up a good business on a basis of practical experience and first-class workmanship.

The *Marengo Republican* of Marengo, Ill., says that the subscribers in that place "are all pleased with the excellent working" of the Gilliland telephone exchange installed in Marengo by William Hubbard, 723 Garden City block, Chicago, the general agent for the Gilliland instrument.

The Chicago office of the Fort Wayne Electric corporation, of which Chas. A. Munson is manager, has been removed from the Adams Express building to the suite comprising rooms 620 to 625 in the fine new Marquette build-

ing. The new offices front on Dearborn street and will be handsomely fitted up.

Every department of electrical activity has become acquainted with the merits of the insulator pins furnished by F. M. Locke of Victor, N. Y., and the result in every case has been satisfactory to the users as well as the manufacturers. Testimonial letters in large numbers are in possession of Mr. Locke and he can find in them many arguments to present prospective buyers.

Charles N. Black's paper on "Large Arc Dynamos," read before the Cleveland convention of the National Electric Light association and published in the WESTERN ELECTRICIAN, has been sumptuously reprinted in pamphlet form by the Brush Electric company, of which Mr. Black is superintendent. The paper is very handsomely illustrated, and is worthy of a position in any electrician's library.

The new incandescent lamp of the Adams-Bagnall Electric company of Cleveland, described in the last issue of the WESTERN ELECTRICIAN, forms the subject of a well-illustrated catalogue just issued. This lamp is sealed at the socket end and has no protuberance at the larger end. The company says it has "a new lamp with a new life," and that the quality as well as the design of the lamp has been improved.

The latest production of the Fort Wayne Electric corporation is a valuable addition to trade literature, being "a complete catalogue of the 'Wood' systems of electrical machinery and apparatus for light and power" manufactured by that concern. The title page is an artistic design and raises the hopes of the observer at once, and it is only just to say that a perusal of the pages following do not result in disappointment. It is all that is claimed for it in the introductory remarks, and the reader concludes an examination of the pamphlet with a much better idea of the extent and importance of this concern in the electrical field as well as the character of the apparatus which it turns out. The company explains the policy it has followed in presenting this catalogue by saying that it "has deemed it advisable to make the descriptive matter as brief as possible, feeling certain that illustrations of the apparatus, reproduced from photographs, and the statement that its machinery and apparatus are manufactured exclusively from the designs of James J. Wood, who has had probably a larger and a more varied experience in designing electrical machinery than any other single individual in this country, having been connected with the mechanical and electrical arts since 1867, and whose reputation as a mechanical and electrical engineer of the highest standing is beyond question, will be more satisfactory to the reader than extended descriptions." The manufacture of all apparatus by this corporation is carried on directly under Mr. Wood's personal supervision, and this is deemed a sufficient guarantee of high efficiency, excellence of electrical and mechanical design and superior workmanship and finish. That others are of the same opinion is amply attested by the great popularity and enormously increased sales of the "Wood" systems of late years. The illustrations are indeed highly artistic, the arrangement convenient, and the special features are brought out prominently. The catalogue was gotten up under the personal supervision of Mr. Wood, and, like everything else that comes from his hand, is thorough in every respect and pleasing to the eye.

## BUSINESS.

The Diamond Machine company of Providence will make an exhibit of its ball-bearing grinder and other machinery for the use of bicycle manufacturers at the Stanley Cycle Show to be held in London, Eng., in November.

The Standard Paint company of No. 2 Liberty street, New York, is sending to its friends a neat card-case and memorandum tablet, which reminds the fortunate possessors that P. & B. products have been "for 10 years the standard."

The Gisholt Machine company of Madison, Wis., has issued a fine catalogue showing some of its machine tools, such as lathes, screw machines and grinders, with pictures of the work turned out by their use. The company has paid much attention to turret lathes, and is a successful advocate of this type of machine. It aims to build machinery of the best quality only.

"The only water-wheel governor that governs," is the claim that is made by the Lombard Water-wheel Governor company, Boston, Mass., for the device it is introducing. The entire system of regulation of this company has been thoroughly described in this journal.

The Farr Telephone & Construction Supply company of 342 Dearborn street, Chicago, reports a good business. This company manufactures guaranteed instruments and all supplies needed in the telephone business. Users report that the Farr telephones are very satisfactory.

Few engine catalogues are more complete than that of the Frick company of Waynesboro, Pa., a new edition of which has just been issued. This company builds the Eclipse Corliss engine, "a genuine Corliss engine with improvements up to date," and its merits are described in 112 profusely illustrated pages.

The Medbery 15 ampere "pony" switches are having an immense sale, and the company is making large shipments daily of its latest device. Being made exactly like the larger switches, it has an appearance of "business," which a trial always substantiates. The connections are absolute and reliable and fully meet all requirements. A large stock is carried by the selling agent, the Mason Electric Equipment company, 307 Dearborn street, Chicago.

The Electric Supply & Manufacturing company of Cleveland, O., announces that the interest and good will of C. H. Estinghausen in the company has been purchased and that he has retired from the management. The company will remain at the old stand, carrying a complete line of electric bells; annunciators, electro-medical apparatus, general electric light supplies, and everything pertaining to this line of trade. In addition it will do extensive construction work of every kind.

W. J. Hammer of New York, the well-known electrical engineer, is stopping at the Auditorium for a few days. His trip west is in his capacity as assignee of Francis R. Upton. He has a considerable stock of both Wood and Knight arc lamps for direct and alternating current, suitable for all classes of work. These lamps are all new, in perfect order and tested ready to hang on the circuit. These goods have to be sold to close up an estate, and we understand Mr. Hammer is offering some very attractive prices. In addition, Mr. Hammer has a large stock of foreign and domestic carbons.

The Link Belt Machinery company of Chicago has issued handsomely engraved invitations, by the kindness of the Essen Coal company of Federal, Pa., inviting inspection of the electric mining plant at that place, which it installed. This is said to be the most extensive electric coal mining plant in the world, the equipment consisting of 16 Independent chain breast mining machines, two 80 horse power Independent four-wheel locomotives, three 150 kilowatt Independent mine type dynamos, 600 horse power Russell steam plant, 22 miles of copper wire, the necessary switchboards, trolley supports, arc and incandescent lamps, etc.

The E. & C. Electric company of Cleveland announces that the Elliott-Lincoln Electric company has been succeeded by the E. & C. Electric company, with the following officers in charge: President and treasurer, J. E. Crawford; vice-president, S. K. Elliott; secretary, W. A. Crawford; electrical engineer, C. E. F. Ahlm, formerly with the Walker Manufacturing company; general manager, G. B. Elliott, also from the Walker Manufacturing company. All matters pertaining to the old company will be settled by the new company, which will continue the manufacturing of slow speed multipolar motors and generators of the highest class.

Julius Andrae & Sons company, Milwaukee, has taken the general sales agency for the Buckeye incandescent lamps. It has a full line of incandescent lamps, covering such a scope that it will be prepared to furnish lamps for almost any voltage, base or purpose. In the purchase of incandescent lamps price is usually what decides; quality is many times not considered. The company also solicits orders for the celebrated Okonite wires, of which it carries a large stock. Its stock of electric light supplies comprises everything pertaining to the business. The new telephone catalogue, which the company has just published, show the latest instruments and complete list of supplies.

The Huyett & Smith Manufacturing company announces that it has transferred its interests to the American Blower company of Detroit. The personnel remains the same, with the exception of the withdrawal of W. D. Smith, vice-president. Mr. Huyett not having been connected with the company for more than ten years, the name is meaningless and the necessity of a change apparent. The new concern will endeavor to maintain the advanced position held by the old company in the manufacture of hot blast apparatus, dry kilns, fans, blowers, engines, and all kindred machinery. The officers are: D. M. Ferry, president; A. E. F. White, vice-president; James Inglis, secretary and treasurer.

The Automatic Circuit Breaker company of Newaygo, Mich., has succeeded the Sweet Electric & Manufacturing company and is pushing the sale of its automatic circuit breakers and limit switches. These circuit breakers are approved by the Board of Underwriters, and indorsed by electrical and mechanical engineers, and specified by them in their specifications for electrical wiring and switchboard work. The company owns and controls patents upon all the principal parts of the device, and has broad claims on the rolling carbon break. The breaking of the current is between carbons, in such a manner that when the metal contact is broken the contact is made on carbons, one rolling upon the other, throwing in a resistance which, before breaking the final contact, reduces the volume, and thus is broken, leaving no possible chance to carbonize the air, and preventing arcing.

A representative of the WESTERN ELECTRICIAN recently met in Cincinnati President H. L. Parker of the Emerson Electric Manufacturing company of St. Louis. Mr. Parker was at the time making a tour of a number of Middle State cities, and he seemed quite encouraged over the business outlook. The Emerson Manufacturing company is a St. Louis concern that has pushed itself steadily to the front until now it stands pre-eminent among the electrical manufacturing companies in that section of the United States. President Parker recently issued a very handsome catalogue descriptive of the company's large line of specialties. As is well known, this concern is the manufacturer of the well-known Meston alternating current motor that is so largely used throughout the United States. It is also doing a large business in designing and constructing special electrical devices. It is needless to say that no little of the company's success has been due to Mr. Parker's energetic efforts. Mr. Parker is an old railway contractor, and has a thorough understanding of how to successfully push large enterprises.

L. M. Moyes, the patentee and manufacturer of the Combine water-tube boilers, announces that he has leased the factory premises at 1434-36 Randolph street, Philadelphia, Pa., where the manufacturing and assembling of his boiler will be carried on, and where the general offices will be maintained. He is at present arranging for the incorporation of his business, with a view to the developing of the manufacturing department. The Combine boiler is in successful operation, and a series of tests have shown gratifying results. Mr. Moyes is erecting boiler plants at various points, and mentions 200 horse power for Thos. Kelly, Philadelphia; 100 horse power for St. Ann's Catholic Schools, Philadelphia; 125 horse power for the Marietta Electric Light company, Marietta, Pa.; 130 horse power for the Washington Agricultural College, Pullman, Washington. Mr. Moyes is about to issue the second edition of his catalogue on "Steam Boilers," which will be sent on application, and will contain some interesting reading for steam users.

The Niagara Falls Hydraulic Power & Manufacturing company has just contracted with James Leffel & Co. of Springfield, Ohio, for four improved double discharge horizontal shaft turbine wheels of 7,500 horse power capacity, which is far the largest head under which turbines of large capacity have ever been applied in this country or elsewhere. These wheels will drive eight large electrical generators, one being placed on each side of each wheel, connecting directly to the horizontal shaft of the turbine, without gears or belting, the electrical current being used for power and lighting purposes. This is the second large order for turbines built by James Leffel & Co. for Niagara Falls, there being already several of their wheels of 1,200 horse power each in the Cliff Paper company's new mills, located at the foot of the cliffs, near the tunnel. The Leffel company is building also four Cascade wheels for one company, to be operated under 730 feet head, a part of these wheels being connected directly also to generators for power in mining operations. The Cascade wheel is entirely different from the turbine, operating upon an impulse and reaction principle. These Cascade wheels will have an aggregate capacity of 600 horse power.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued October 22, 1895.*

548,176. Magnetic Ore Separator. Charles G. Buchanan, Brooklyn, N. Y. Application filed February 13, 1895.

A revoluble drum, containing stationary magnets within it, and an endless belt below the drum with its ore-carrying side within the influence of the magnets, and devices for feeding ore upon the drum.

548,210. Telephone Receiver Support. Isidor J. Kusel, St. Louis, Mo. Application filed February 18, 1895.

A rigidly fixed hook, a spring-actuated plunger passing through the base of the hook, a resilient metallic strip carried by the end of the plunger, contact plates located upon each side of each end of the resilient strip, and with which the conducting wires from the talking and ringing circuits are connected, are the main features of this invention.

548,217. Method of and Apparatus for Rectifying Alternating Currents. Jules E. Neher, Pittsburg, Pa. Application filed August 7, 1893.

This method of utilizing electric currents derived from an alternating current transmission circuit for supplying translating devices having an approximately constant counter electromotive force, consists in rectifying them and transmitting the rectified, fluctuating currents to the translating devices through a choking coil, and thus producing a magnetic field of one direction, whereby reversed currents due to the counter-electromotive force of the translating devices are prevented.

548,227. Telephone Exchange Apparatus. Charles E. Scribner, Chicago, Ill. Application filed March 5, 1892.

The first claim is for the combination with a telephone line, of an individual annunciator consisting of a main retaining magnet and its armature, and a restoring magnet, and the armature thereof acting as a drop, the drop being normally engaged by the armature lever of the retaining magnet, and when so in engagement resting a short distance from the pole of the restoring magnet, and a key included in the circuit of the retaining magnet, the drop when attracted to its pole being adapted to open the key.

548,228. Apparatus for Telephone Switchboards. Charles E. Scribner, Chicago, Ill. Application filed February 28, 1895.

A telephone line, a relay included in the line circuit, a local circuit including a source of current and a subsidiary signal controlled by the relay, and means for short-circuiting the signal when connection is made with the line, are features claimed.

548,229. Keyboard Apparatus for Telephone Switchboards. Charles E. Scribner, Chicago, Ill. Application filed February 7, 1893.

The cut shows an arrangement including a pair of connecting plugs connected by conductors, a socket for one of the plugs wherein it rests when idle, a cord switch having contact points arranged to be separated when the plug is in its socket, an annunciator, and circuits connecting the annunciator through the cord switch contacts with the plug circuit.

548,230. Method of and Means for Temperature Adjustment for Inductance Coils. Oliver B. Shallenberger, Rochester, Pa. Application filed April 15, 1895.

An inductance coil is provided, a core having interruptions or air gaps, and an expansion bar for automatically varying the dimensions of such air gaps in accordance with changes in temperature.

548,231. Phase Adjustment. Oliver B. Shallenberger, Rochester, Pa. Application filed April 15, 1895.

The method of obtaining a magnetic field in quadrature with the impressed electromotive force consists in lagging a derived current, producing thereby an independent lagging primary magnetic field, inducing by the field secondary currents, and adjusting the secondary currents to produce a secondary magnetic field of definite value, and combining the primary and secondary fields to form a resultant field of the required phase relation.

548,266. Automatic Switch for Electric Transformers. Anthony G. New, London, and Arthur J. Mayne, Woking, England, and Richard N. Lucas, Galway, Ireland. Application filed June 25, 1894.

The device comprises a weighted or spring controlled lever operating the main switch, a pair of solenoids, a core in one of them adapted to engage with a catch, means for withdrawing the catch, a connection between the cores of both solenoids, a spring carried by the second core, the spring being attached to one end of the pivoted lever, a contact arm operated by the second core, and means for holding the lever against the action of the spring and releasing the same.

548,280. Electric Stop Mechanism. William M. Wood and James C. Miller, Elmira, N. Y. Application filed June 7, 1894.

The arrangement includes motor mechanism and a switch device connected with an electrical generator, trip devices for releasing the motor mechanism and switch devices and electrical devices constructed and adapted to operate all the trip mechanism by the use of a single circuit closer, whereby the machinery may be stopped and the source of electrical energy simultaneously cut out.

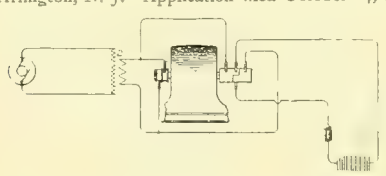
548,282. Electro-mechanical Lock. William W. Alexander, Kansas City, Mo. Application filed November 15, 1889.

A wheel having upon its periphery a series of teeth at regular intervals, a coiled spring upon the shaft of the wheel to propel it in one direction, and also to form a part of an electric circuit, a pin also carried by the shaft, and the adjustable contact spring.

548,331. Magnetic Brake. Oakley S. Walker, Worcester, Mass. Application filed February 20, 1895.

The last claim is given: In a magnetic brake the combination of a shell provided with a surface adapted to fit the periphery of a wheel, a core and an annular chamber inclosed in said shell, an electric coil held in said chamber, and a binding post consisting of a bolt carried by said shell, a tightening nut on said bolt, a pair of collars provided with semi-circular recesses to receive the wires and insulating washers.

548,369. Electric Desk Light. Walter R. Kinsman, Arlington, N. J. Application filed October 14, 1893.



NO. 548,217.

There is a cylindrical casing, having a removable cap on one end and having a portion of its side cut away, the cap fitting over the end of the casing, and having an aperture, an electric lamp horizontally arranged within the cylindrical casing, and having its socket inserted through the aperture, so that the key is without the casing, means for securing the lamp in position, comprising two spring collars arranged around the socket upon opposite sides of the cap, and bearing against the same, a shade concentric with the cylinder and located within the same, and means for rotating it.

548,371. Electric Locomotive. Walter H. Knight, New York, N. Y. Application filed June 15, 1888.

The combination is claimed with the opposite axles of a vehicle, of an intermediate electric motor spring centered about one axle, at its yoke end a frame joining the axles from which the free end of the motor is suspended, and a car-body having a spring support on the axles independently of the frame.

548,383. Magnetic Separator. James D. McKinnon, Portland, Ore. Application filed April 16, 1895.

A magnetized device, a non-magnetic belt having its forward portion arranged adjacent to the magnetized device, and a magnet or plurality of magnets arranged below the upper portion of the non-magnetic belt.

548,388. Regulating Electric Motors. William B. Potter, Schenectady, N. Y. Application filed July 22, 1895.

It is provided that in a series multiple or three-wire electric railway having two tracks or sets of conductors, adjacent conductors for the different tracks shall have the same sign and potential.

548,389. Three-wire Electric Railway. William B. Potter, Schenectady, N. Y. Application filed August 8, 1895.

This three-wire electric railway system is composed of two dynamos in series, a track or ground return forming one side of the system, and metallic conductors forming the neutral and the other side of the system.

548,396. Electric Cigar Lighter. Friedrich W. Schindler-Jenny, Kennelbach, Austria-Hungary. Application filed February 19, 1894.

Two separate heat bodies are each provided with parallel channels or openings extending through from the top to the bottom, and there are two separate conductors applicable respectively to the heat bodies, and running each alternately from the top to the bottom, and vice versa through the channels or openings, and a case to receive the heat bodies with the conductors.

548,400. Regulator for Alternating Currents. Charles P. Steinmetz, Schenectady, N. Y. Application filed April 18, 1895.

One claim is for a feeder regulator for an alternating current system of distribution, composed of two stationary coils arranged at an angle to each other, a laminated iron magnetic structure furnishing a path for the lines of force between the coils, and a movable magnetic member arranged to vary the path of the lines of force.

548,401. Electric Motor. Imle E. Storey, Hornellsville, N. Y. Application filed January 28, 1893.

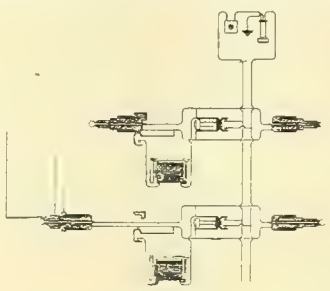
A field magnet having two pole pieces facing each other, each having two horns and being substantially T-shaped, in combination with two field magnet coils crossing each other and embracing the diagonally opposite horns of the pole pieces.

548,402. Electric Motor. Imle E. Storey, Hornellsville, N. Y. Application filed January 28, 1893.

This motor consists of a hollow body or shell of magnetic material made in two closed cup-shaped parts, secured together and inclosing a single field magnet coil, an armature whose working faces are at right angles to its shaft, and pole pieces projecting inward from the parts of the shell and facing the sides of the armature.

548,406. Dynamo-electric Machine. Elihu Thomson, Swampscott, Mass. Application filed March 29, 1895.

The machine has a stationary armature provided with independent windings overlapping in sets, the sets not overlapping each other, and separate circuits extending from each independent winding.



NO. 548,229.

548,413. Electric Arc Lamp. Thomas E. Adams, Cleveland, O. Application filed July 8, 1895.

The cut shows an arc lamp, in which the inventor claims the combination with the electrodes of a coarse wire helix, a switch for switching the coarse wire helix into and out of a low resistance circuit around the electrodes and a weighted armature and armature lever, and devices connected with the armature lever for adjusting and feeding the electrodes, the parts being constructed and arranged so that the weighted armature serves to retain the electrodes in a separated relation when no current is passing through the lamp and on the passage of current through the lamp to be raised by its acquired momentum above its normal position for feeding the carbons, and thereby bring the carbons into contact, and then open the switch contacts and switch the coarse wire helix out of circuit, and then fall into its normal position for feeding, and separate the electrodes and establish an arc between them.

548,414. Electric Arc Lamp. Thomas E. Adams, Cleveland, O. Application filed July 10, 1895.

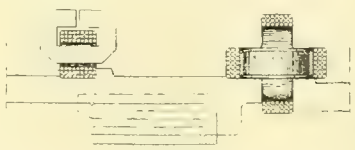
A feature of this lamp is the combination with the clamping plate and lever pivoted thereto, the lever being provided with a shoulder located above its pivot bearing, of a clamping plate or shoe constructed and arranged to have a movement independent of that of the lever, and provided with rounded seat, against which bears the shoulder on the lever.

548,419. Electric Metering Apparatus. William S. Barstow, Brooklyn, N. Y. Application filed April 6, 1895.

This apparatus has two independent meter trains, a propelling motor, and a controlling clockwork for throwing the meter trains into connection with the motor in alternation.

548,435. Electric Block Signaling Instrument for Railways. Arthur C. Fraser, Brooklyn, N. Y. Application filed February 26, 1891.

A signal-setting instrument for railway block signaling is described, consisting of a circuit-controlling part or commutator movable to a safety position and a plurality of danger positions, a safety motive device and actuating mechanism interposed between it and the part adapted upon each impulse from the motive device to move the part one space toward the safety position, and a danger motive device adapted to move the part from any other position to the extreme danger position.



NO. 548,231.

548,467. Electric Meter. William H. Scott, Norwich, England. Application filed November 4, 1892.

An electricity meter having an electro-dynamo meter is provided with conductors in series and in shunt, one of the conductors being movable in combination with means for periodically making and breaking the shunt circuit, whereby the moving conductor is made to move periodically an amount in proportion to the watts, or amperes multiplied by volts, in the circuit.

548,481. Underground Conduit for Electric Railroads. Richard Uren, Hancock, Mich. Application filed May 10, 1894.

An open insulated conduit for electric railways is described, partly filled with water or other conducting fluid, having a stratum of oil or other non-conducting fluid of less specific gravity superimposed thereon and a conductor located in the conduit and surrounded by the conducting fluid.

548,504. Combined Electric and Cable Railway. Gardner E. Beach and Morris J. Kern, San Francisco, Cal. Application filed August 1, 1892.

This is an electric railway, having a short cable section, a supplemental conductor co-extensive with the cable section, and a motor for operating the cable section in series with the supplemental conductor, and driven from the main line circuit when the circuit is closed through the supplemental conductor by the entrance of a car on the cable section.

548,510. Electro-magnetic Brake. John L. Black, St. Louis, Mo. Application filed April 13, 1895.

In an electro-magnetic brake there is the combination of a magnet having an unobstructed central opening, cores formed in sections movably secured together, and connections between the outer sections of the cores and the brake mechanism.

548,511. Method of Converting or Transforming Periodic Electric Currents to Obtain Constant Effective Intensity or Voltage. Paul Boucherot, Paris, France. Application filed December 10, 1892.

This method of obtaining a constant effective difference of potential where a current of constant effective intensity is given consists in combining in shunt in the circuit in which the current of constant effective intensity is given an apparatus possessing electrical capacity and one having the quality of self-induction, whereby the constant difference of potential will be found between the one or other pair of adjacent terminals of these two apparatus.

548,514. Underground Conduit System. Hiram C. Burk Cleveland, O. Application filed February 28, 1893.

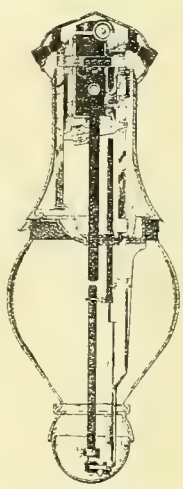
In this underground trolley system there is the combination of a line wire inclosed in insulating material in the conduit wall, a strip or series of strips hinged to the wall but insulated therefrom and located under the conduit slot, bell crank levers pivoted in the insulating material and provided with long arms located under the line wire, and short arms adapted to support the strip or strips with insulating blocks between the line wire and longer arms.

548,574. Phosphorescent Electric Lamp. Daniel McF. Moore, New York, N. Y. Application filed January 3, 1895.

An evacuated inclosure having relatively yielding electric contacts therein is provided, and means for vibrating them relatively to such an extent that at each approach they just escape each other.

548,575. Phosphorescent Electric Light Condenser and Accumulator. Daniel McF. Moore, New York, N. Y. Application filed January 24, 1895.

A phosphorescent electric light accumulator is described, consisting of the combination of an evacuated tube, separable electric contacts normally touching each other, located at one end of the tube, and having a return wire passing throughout the length of the tube and located in circuit with the secondary coil of a given electric transformer, means for causing the terminals to vibrate to and from each other, and a conductor or semi-conductor located at or near the tube.



548,413.

548,576. Phosphorescent Electric Lighting by Interruptions. Daniel McF. Moore, New York, N. Y. Application filed January 24, 1895.

In a system of phosphorescent electric lighting there is the combination with a source of current of an evacuated inclosure containing conductors connected to the source, a circuit breaker and maker interposed in the circuit, and a magnet also interposed in the circuit for the operation of the circuit maker and breaker, and to act as an inductive resistance.

548,583. Electric Snap Switch. Joseph H. McEvoy, Waterbury, Conn. Application filed February 18, 1893.

The combination includes peripheral contacts, a rotary switch bar, and means for actuating it, the switch bar being arranged between the peripheral contacts, and constructed with upturned ears provided with detachable and yielding contact plates.

548,589. Electric Stop Motion for Engines. Louis St. Peter, Springfield, Mass. Application filed March 1, 1895.

There are a valve-operating device of the engine, an electro-magnet and armature, electric conductors for forming a circuit, means for closing the circuit, a lever to act on the valve-operating device and engaged by the armature of the electro-magnet, all so that on the closing of the circuit and energizing of the magnet the armature is withdrawn from its lever-engaging position, leaving the lever free to be swung.

548,599. Electric Street Car Controller. Gustaf Valley, Cleveland, O. Application filed December 5, 1894.

The combination consists of the drum and switch of a street car controller, a disk attached to the drum and having notches corresponding to the operative positions of the drum, a notched disk attached to the shaft of the switch, a locking pawl adapted to engage at one end the disk on the drum, and at the other the disk on the switch shaft, and a disk affixed to the case of the controller beneath the handle, and having a notch through which a lug on the handle must pass when the handle is put in place or removed.

548,601. Electric Switch. John L. Black, St. Louis, Mo. Application filed April 13, 1895.

This device comprises a pair of magnets having heads, and arranged end to end, the fixed cores located within the magnets, the coiled springs located within the heads, the movable cores located within the magnets between the springs and the fixed cores, and a rod having its ends extending through the heads and through the springs, and connected with the movable cores.

# Western Electrician.

EVERY SATURDAY.

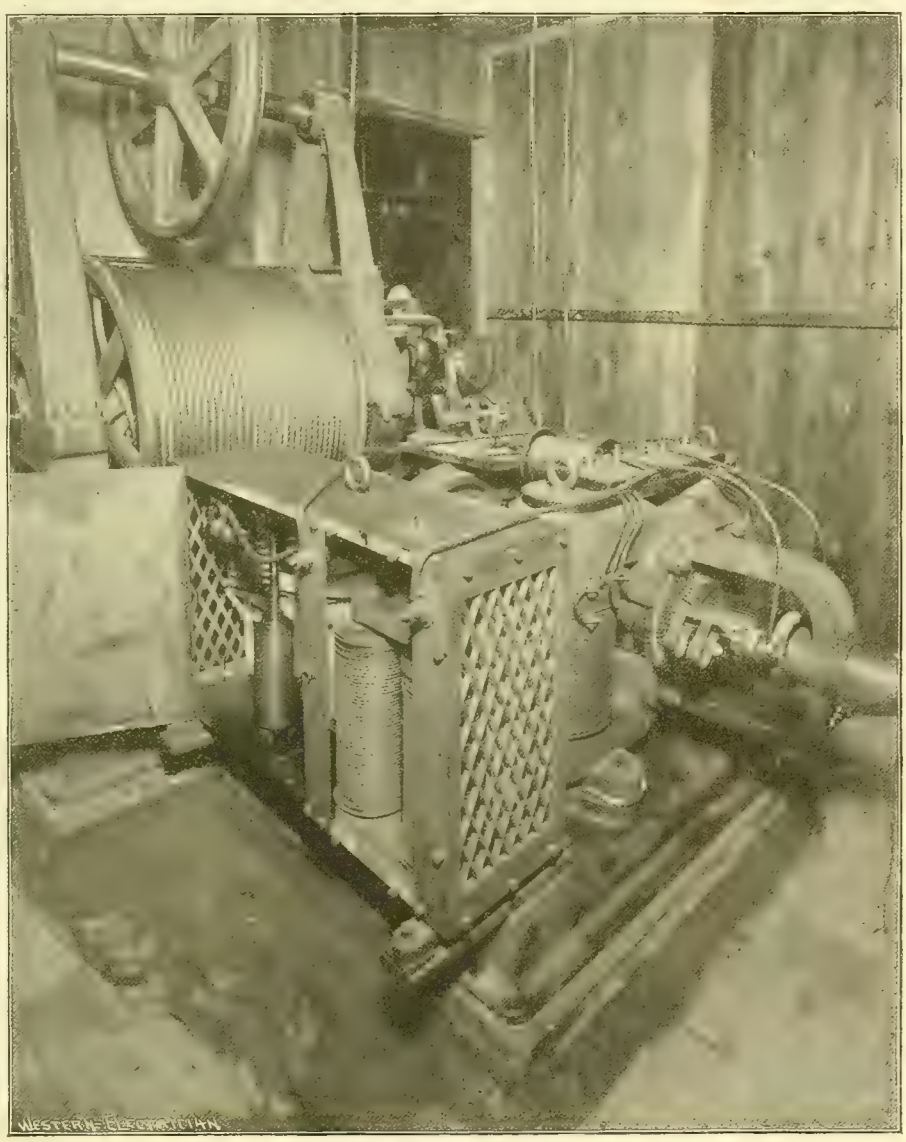
Vol. XVII. CHICAGO, NOVEMBER 9, 1895. No. 19


## Typical Electric Elevator Plant.

The illustration shows one of the latest electric elevator plants in Chicago. The installation of electric elevators has become to be one of the most promising lines of development in the application of electric motors, and the plant herewith illustrated is selected as an example of present-day practice. This equipment is not a hydraulic or steam elevator remodeled, but was primarily designed and operated as an electric elevator, with no provision for the use of other power.

Recently the State street store of John T. Shayne & Co. was remodeled, and it was decided to put in an elevator, among the other improvements. An electrical equipment was selected, and the plant illustrated in the picture was installed. Power is obtained from a 220 volt circuit connected with the Chicago Edison company's mains, which also supplies current for the incandescent and low-tension arc lamps in the building. The motor is of the Keystone bipolar type and drives the elevator drum by means of a worm gearing. It is rated at 20 horse power and takes 60 amperes of current.

The starting box, shown open in the picture, is simple but efficient. By the combination of a powerful bar magnet with a lever arm traveling over the contact segments of a rheostat, further controlled and steadied by a coiled spring and a dashpot, the resistance is cut out automatically precisely as required by the load on the motor. The brake is on the coupling between the armature shaft and the worm gearing, and above this is the reversing switch, boxed in, but shown uncovered in the picture. The whole arrangement is very compact and simple and responds easily and smoothly to the movements of the controlling lever in the car. There are two counter-balances—one for the drum and the other for the car. The elevator travels through four stories and a basement and is almost constantly in motion during business hours. The car will carry twelve persons comfortably, and the plant is highly praised by all connected with the establishment.



TYPICAL ELECTRIC ELEVATOR PLANT.

## Trolley Equipment on Indiana Avenue, Chicago.

After contending with very active opposition on the part of property owners, the Chicago City Railway company has at last succeeded in erecting poles and stringing wires for an electric railway on that part of Indiana avenue between Thrty-ninth and Fifty-first streets. The work was begun at midnight on last Saturday, and in 22½ hours of actual work a force of 300 men planted a double line of poles extending 1½ miles, strung the span and trolley wires, put in two switches and a railway crossing, and arranged numerous track and crossing details necessary to the operation of the cars.

Thirty hours before the first car was run preparations were commenced for the record-breaking job. Supt. Bowen looked after the details. Plans had been going forward for this work several days. Behind a board fence at Thirty-ninth and Wallace streets wagons were being loaded on Saturday, and horses were fed after the hasty plan of the summer circus. Care was taken that no one saw what was going on in the inclosure.

At 11:40 P. M. on Saturday the gates opened and a great cavalcade passed east in Thirty-ninth street. There were 20 teams drawing steel trolley poles, 50 teams with loads of macadam, 30 wagons of sand, 10 loads of cement, and four of tools. In the procession were four tower wagons, two crane wagons, several water tanks and a wreck wagon.

To accomplish the job the men worked steadily 36 hours, 16 of which were in preparation. They were fed in a restaurant adjacent. A horse car used as headquarters for the head men was run out on the track as soon as the work began, and was moved along as construction advanced. The total number of workmen engaged was 300.

Five cars of the 1895 pattern, just ready to be turned out of the Pullman shops and said to be the finest yet made, will be put on the line. They will be olive green instead of the shamrock shade in vogue and fitted in cherry and nickel and lighted by the Pintsch gas system.

"We knew the vast majority of property owners wanted the electric service," said one of the officials, "but we feared from the fad of opposition further north that some one might get out an injunction against us and delay the work after starting, although we have held the consent of a majority since August. The opposition of one man might have been as disastrous as if he was backed by a majority. So we did the work when legal interference was impossible."

## A Storage Battery Railway for Chicago.

The storage battery industry is coming to the front by leaps and bounds. The latest development is the closing o a deal by which a storage battery road in Chicago and its suburbs seems to be assured. This will be the first considerable electric railway in the United States to rely on storage batteries for power, and if the line achieves the commercial success which is predicted for it, it will undoubtedly exercise great influence on the street railway development of the country.

The Englewood & Chicago Electric Railway company has sold its franchises and property to a syndicate of capitalists that will complete and greatly extend the system, equipping the whole with storage batteries and electric motors. The Chicago & Morgan Park Street Railway company has also passed into the control of the syndidate, and its franchises will be used. These two companies have franchises, with a few miles of road built, for a network of electric railways in the southern part of Chicago, south of Sixty-third street, and adjacent territory in and about Morgan Park, Blue Island and Washington Heights. This suburban district is not thickly populated, but it is estimated, nevertheless, that a population of 150,000 would be tributary to a satisfactory system of transportation on the lines laid out.

The deal which resulted in the purchase of the lines was engineered by Edward F. Cragin. The purchasing syndicate is headed by J. C. Shaffer, while many of its members are prominent stockholders in the Electric Storage Battery company of Philadelphia. Among the directors of this concern are some of the wealthiest men in the country, August Belmont, John I. Waterbury, president of the Manhattan Trust company of New York, and President Griscom of the International Navigation company are said to be largely interested in the enterprise just launched.

A contract will undoubtedly be entered into with the Electric Storage Battery company to furnish batteries for the new lines. The Chicago & Morgan Park franchise, which was obtained some time ago by W. V. Jacobs, grants the privilege to construct about 50 miles of double track from Cottage Grove avenue in Seventy-first street to State street, then south to One Hundred and Fourth street and then west to Morgan Park. East Chicago Heights and other suburban villages will be tapped.

The work of building the new road has been delayed for want of funds, but will now be pushed to early completion. Nearly four miles of the Englewood and Chicago road has already been built. It runs in Vernon avenue from Sixty

[illegible] connection is made with the Alley "L" to Sixty-seventh street to a junction with the Calumet electric system, to which it was recently leased for five years. Under the contract, however, the Englewood company has the right to run its cars over the track.

The authorized capital stock of the Englewood and Chicago line is $2,500,000, but it is understood that only $300,000 of this has as yet been issued, all of which was held by W. V. Jacobs. The authorized bond issue is $2,500,000. The Morgan Park company is capitalized at $2,000,000, but nothing has been done in this enterprise since the ordinance granting right of way was given by the council.

Plans have been devised to immediately float the securities of the new enterprise. An abundance of capital is behind the scheme and most of the stock has already been taken.

According to the contract under which Mr. Jacobs sold his franchise the purchasers agree to expend $1,500,000 on the roads. Mr. Jacobs is an extensive owner of property in the district through which the lines will run. He retains an interest in the enterprise, the control of which, however, has passed out of his hands. The construction of the roads will be an important factor in the development of the territory in the southwestern part of the city.

The promoters of the enterprise are confident that a storage battery road can be successfully operated in Chicago, and they are backing their opinion with money in a very business-like way.

## Tests of the Baltimore & Ohio Electric Freight Locomotive.

The 96-ton electric locomotive has now been in operation on the belt line of the Baltimore & Ohio railway since August 4th last, hauling the entire north-bound freight service of that railroad. Every train has been handled promptly and the locomotive has been ready at all hours during the day, causing no delay to traffic. Nothing has occurred to interrupt the excellent work of the locomotive, which has responded to every call without failure either of speed or power.

A few weeks ago a test was made to learn its capacity for running a loaded train on an up-grade. For this purpose a train consisting of two steam locomotives, not working, and 27 loaded freight cars, was brought to a stop while going north through the tunnel. Here the grade is 42 feet to the mile and the rails were damp and greasy. The weight of the train was 1,125 tons, or 1,221 including the electric locomotive. Every drawbar was tight, no slack occurring throughout the length of the train. In this condition current was turned into the motors and movement was immediately communicated to the train. At the end of one minute the train was moving at a speed of 10½ miles an hour, and at this point the speed was increased to the usual rate. The total distance moved in 40 seconds was 150 feet and at the expiration of one minute 450 feet.

A few days ago a test was made with a dynamometer car placed between the electric locomotive and the train, which consisted of 22 cars loaded with coal, one caboose and two dead locomotives. The total weight was 1,068 tons. On the 10 per cent. grade in the tunnel an average drawbar pull of some 25,000 pounds was obtained from the dynamometer diagram. The speed at this point was 11⅛ miles per hour. Comparison with the diagrams obtained in similar service with steam locomotives showed a remarkably uniform and steady pull by the electric engine, due to the absence from it of reciprocating parts, the torque being constant throughout the entire revolution of the wheel.

A further test was made with another train, consisting of 36 cars, one caboose and three dead engines. This was a regular through freight train with a local freight attached, and the total weight was in excess of 1,600 tons. It was hauled with ease through the tunnel, and calculations from the previous dynamometer records and the drawbar pull per ampere showed a drawbar pull of over 45,000 pounds.

A test made on October 6th has added a new record to the list of remarkable performances of this locomotive. The character of the performance is heightened by the fact that the train which it moved measured over 1,800 feet in length and weighed about 1,900 tons, and was started from rest in the tunnel. It consisted of a north-bound freight train of 28 loaded cars and two locomotives coupled to a local freight of 15 loaded cars and one locomotive. In starting not a sputter, spark or slip of the wheel occurred, and the train moved with the same precision as if the circumstances had been of the ordinary character. The drawbar pull of 60,000 pounds was about the record in this case. The train was quickly brought to a speed of 12 miles an hour and pulled through the tunnel without difficulty, with the locomotive continuously exerting a drawbar pull of 40,000 pounds.

Up to the present time no train which would hold together has been found heavy enough to cause the electric locomotive to slip its wheels under ordinary fair conditions. The capacity of the locomotive has been by no means reached. The tests have only shown approximately what the locomotives can do. A dynamometer car of sufficient capacity to test the maximum drawbar pull will shortly be secured, when definite figures can be obtained.

An extension of the overhead work of the electric equipment north to Waverly is being planned by the Baltimore & Ohio Railroad company. The extension would secure the service of the electric locomotive on the grade from North avenue. It is also contemplated to build south to Baylies, where housing for the electric locomotives will be built. The one now in use is at present sidetracked in the open air when not making runs.

The two additional machines ordered by the Baltimore & Ohio company are nearing completion at the works of the General Electric company at Schenectady, and when finished the passenger service through the tunnel will be undertaken by them. The illustration shows the electric locomotive coupled to a north-bound freight train issuing from the tunnel.

TESTS OF THE BALTIMORE & OHIO ELECTRIC FREIGHT LOCOMOTIVE.—ELECTRIC LOCOMOTIVE AND FREIGHT TRAIN LEAVING THE NORTH EXIT OF THE TUNNEL.

## American Electro-therapeutic Association.

At the recent annual meeting of the American Electro-therapeutic association, held in Toronto, nearly thirty papers were read on the varying aspects of the use of electricity in medicine and surgery, showing the great advance that has been made in electro-therapeutics in the last few years. Officers were elected as follows: President, Dr. Robert Newman of New York city; vice-presidents, Dr. Holford Walker of Toronto, Ont., Dr. D. B. D. Beaver of Reading, Pa.; treasurer, Dr. R. J. Nunn of Savannah, Ga.; secretary, Dr. Emil Heuel of New York city; executive council, Dr. W. J. Morton of New York city, Dr. G. Betton Massey of Philadelphia, Pa., Dr. W. J. Herdman of Ann Arbor, Mich., Dr. Emil Heuel of New York city, Dr. Wendell C. Phillips of New York city. The president has appointed the following committees: Committee on Induction Coils and Alternators—Dr. A. H. Goelet, chairman; Dr. G. Betton Massey, A. E. Kennelly. Committee on Meters—Dr. M. A. Cleaves, chairman; Dr. O. B. Douglas, W. J. Jenks. Committee on Static Machines and Condensers—Dr. W. J. Morton, chairman; Dr. W. J. Herdman, Dr. J. H. Kellog. Committee on Constant Generators and Controllers—Dr. W. J. Herdman, chairman; Dr. Robert Newman, R. G. Brown. Committee on Electrodes—Dr. C. R. Dickson, chairman; Dr. Lucy Hall-Brown, Dr. E. C. Riggs. Committee on Electric Light Apparatus for Diagnosis and Therapy—Dr. J. H. Kellog, chairman; Dr. E. C. Riggs, J. J. Carty. It was decided to hold the next annual meeting of the association in Boston, Mass., in the latter part of September, 1896.

## Moulders' Sand Treatment for Electric Shock.

John Ehlman, who runs the electric crane of the Tuttle Manufacturing & Supply company in Anaconda, Mont., received a severe shock recently. Something had broken in the crane, and the electricity was shut off pending repairs. These being completed, the current was turned on, Ehlman being still on the crane. Sparks flew out immediately in front of him, and he received a shock. He at once descended and went outside, where he fell insensible, and was thought to be dead. The moulders, not knowing what else to do, dashed water on him and then buried him in a pile of moulders' sand. Cold water from a hose was turned on him and then hot water. When the doctor arrived, he had survived this heroic treatment and was conscious. He received about 500 volts in the shock, but when consciousness returned seemed but little worse for the experience, but was very nervous.

## Co-operation of Electric Railway Officers and Firemen.

As a result of a recent fire at the Crescent linseed oil mills in Chicago, General Manager Parsons of the West Chicago Street Railroad company has promised Mr. Swenie, the head of the Chicago Fire Department, that, in the event of notification from the department that a fire is in progress on any street equipped with the company's overhead feeders or trolley wires, the current to that section of the system will be promptly cut off at the power house. With the current shut off the wires themselves are little, if any, hindrance to the firemen, and in nearly every case the managers of electric street railways stand ready to co-operate with the firemen in this respect if given due notice.

## Result of Barrett's Blunders.

[From the *Chicago Tribune*.]

According to expert testimony, backed with reliable statistics, Chicago's municipal electric light plants cost the people more a light than those of any city in the country.

## Simple Device for Shunting Heavy Currents on Broken Circuits.

A. E. Hutchins of Detroit has devised the simple appliance illustrated in Fig. 1 for diverting any dangerous current in the case of the breaking of a street circuit. He puts a small wire on a pole similar in purpose to a lightning rod for a house; the top of this wire he splits into a fork, or fastens to a specially made insulated metallic bracket; the bottom of the wire is run into the ground, where it may be connected to a special ground wire or a water or gas pipe. This bracket or crotch only touches a bare spot on the suspended dangerous wire when it falls, then it operates to carry the deadly current down the pole wire to the ground. Electrically speaking it provides for the electric current a low resistance shunt, and places the fallen wire at earth potential, similar to the ground current of an electric railroad. The inventor also claims that his device protects from any additional grounded dangerous wires at other points on the line.

A photographic reproduction of a test made by Mr. Hutchins at the station of the Peninsular Electric Light company in Detroit is given in Fig. 2. Writing of this experience, the inventor says: "In this test I complied with the requirements of protection to life from a broken section of line wire and also from a superimposed wire grounded in moist earth 250 feet distant from operating grounds. This line carried a 3,000 volt arc light circuit from a 75 light Brush machine, one span (on one leg or polarity) of which was guarded at each pole by my bracket or receiver, and when this span of wire was severed I picked up either end of the fallen wire, engaging the naked wire, as shown in the photograph, there being at that time a 3,000 volt potential ground (from the opposite polarity of the machine) playing through the ground from moist earth ground 250 feet away. My protecting brackets were grounded each to a water pipe. In this test I could not perceive the least current passing through myself, even when I approached to within 100 feet of the point where the special wire was grounded in moist earth. Though, of course, no new principles of electrical science are involved, yet this is a new application, in taking advantage of conditions afforded by the earth as a low resistance conductor, operating to afford protection or relieve a conductor of higher resistance, such as the body of a man."

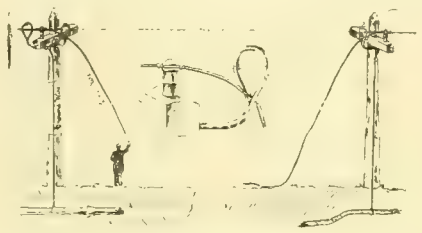


FIG. 1. SIMPLE DEVICE FOR SHUNTING HEAVY CURRENTS ON BROKEN CIRCUITS.

FIG. 2. SIMPLE DEVICE FOR SHUNTING HEAVY CURRENTS ON BROKEN CIRCUITS.

## Telephone Service on the Board of Trade.

The new private-line telephone service in the Chicago Board of Trade, described in detail in the WESTERN ELECTRICIAN of September 21st, appears to be so efficient that the jealous opposition of those depending on the public service has been aroused. The situation is thus described in the financial columns of the *Chicago Tribune:*

It does seem that the Board of Trade people never know when they are well off, or at least do not hold to any one opinion on a proposition for any length of time. The private telephone service between the floor of the Board of Trade and the offices of various brokers has only been in operation a few weeks. The telephone company put in a large number of handsome instruments of special design and the change was looked on in the light of an improvement. There were people, to be sure, who opposed the installation of private telephones on the floor of the board at all, but it was supposed that they would do away with a great deal of the unpleasant confusion incident to the old messenger service. Complaints are now being made by commission houses as to the use being made of the telephones by some of the private-wire concerns. The public telegraph service has been gotten down to such a fine point that a New York order by means of signs can be executed in a remarkably short time. Comparisons as to speed have gotten down to seconds, and the complaint is that the private-wire houses by the use of their telephones, which are located near the pit, can beat the houses which depend on the public service and have no private-wire connection, by twenty to thirty seconds on an order. Even the quotations, it is said, are sent out by private houses in advance of the quotations sent by the board. Speculative trade is so poor on the board that the rank and file of brokers are apt to be in fault-finding humor. Elevators and the private-wire houses have always been pointed to as the reason for concentration of cash and speculative business in a few hands and the decrease in speculative interest in the grain market here. It is urged that the present use of the newly installed telephone service simply tends to a further concentration of business in the hands of a few private-wire houses.

## Electrical Blacksmith Shop.

Probably the only blacksmith shop in the country without a forge is operated by William Patterson at Niagara Falls. The great cataract supplies the power. The decomposition of water by the electric current is an old and well-known phenomenon, but the heating of the negative electrode by the ignition of the liberated hydrogen gas has only recently attracted the attention of those interested in electric heating, welding and forging. The first method of heating a piece of metal by the liquid forge was to connect a lead plate to the positive wire and a pair of tongs to the negative. Then by grasping with the tongs the metal to be heated and immersing it in the vessel containing the positive electrode and a good conducting solution of dilute sulphuric acid or soda, the metal will begin to increase in temperature, and if the operation is continued long enough will melt. All the time it is increasing in temperature it is in view of the operator, and can be withdrawn when the desired heat is obtained.

The above method of electric heating by complete immersion requires considerable current, and this led George D. Burton to perfect the method now used, of holding the metal to be heated in contact with the surface of the liquid, and as the hydrogen gas is given off it is ignited directly in contact with the metal, which absorbs the heat generated.

The time required to heat iron varies. It takes eight seconds for a piece of iron one-quarter inch square cross-section, to one minute for a piece one inch square; the latter requires 26 amperes at 220 volts, which cost, it is claimed, less than a quarter of a cent for current. The cost of preparing a horse shoe with a coal forge, with coal at $5 per ton, is 5.85 cents; with the electric forge, and current at 15 cents per 1,000 watt hours, it is 2.32 cents.—*American Manufacturer.*

The Peshtigo Lumber company of Peshtigo, Wis., will add an electric light plant to light its mill, machine shop, store and offices.

## Weird Jersey Lightning.

There must be something in the New Jersey soil peculiarly attractive to lightning, is the conclusion reached by the New York *Sun*. That eminent authority remarks that in other regions a thunder storm, if very severe, damages a building or two or possibly kills a man with a direct bolt. In New Jersey it doesn't act that way. Some peculiar and weird manifestation invariably characterizes a storm there. If a man is killed by a bolt there are a dozen witnesses to tell how he was wrapped in a spiral of flame and spun round until he fell dead. When a house is struck the lightning disdains to do anything as commonplace as merely to rip off the roof or set fire to the building. It usually slides down the chimney, cavorts round the room, destroying any household pets that get in its way, and ends by wiping the ornaments off the mantelpiece and branding the date of its arrival on the face of the clock.

Its latest wonder of this kind occurred some time ago on Austin Emmons' farm, near Hacklebarney, in Chester township. Mr. Emmons possesses as fine a 300 acre farm as there is in New Jersey. In his big field just back of the house he keeps 75 sheep, which at night gather under a spreading cherry tree at one end of the field. As the sheep are valuable he has them all insured against death by accident—accident in this case having reference chiefly to lightning, as that is the commonest form of accidental death to animals in that part of New Jersey. In his farming experience Mr. Emmons has lost many fine cattle and sheep from this cause, but none under such strange circumstances as this last time.

It was about three o'clock in the morning when the storm came. Mr. Emmons was aroused by a tremendous flash followed by a great hissing noise.

"There goes another brook, dried up by one of those confounded flashes," he grumbled. "If this keeps on there won't be anything but steam left for the cattle to drink."

Then he carefully adjusted the glass casters on his non-conductor bed, saw that the rubber blocks were placed under them, and, wrapping himself up in his feather quilt, turned over to sleep again. But he could not go to sleep. There was too much electricity in the air. It tingled in his every nerve and made his muscles jump convulsively. Everything in the room was affected. On the washstand the water pitcher and the tooth mug were spitting fire at each other, and a flickering halo of jagged flame played around the bureau mirror. Unable to endure this longer, Mr. Emmons jumped out of bed. In putting on his shoes he sat down on a flash of electricity that lifted him nearly to the ceiling. Meanwhile outside occasional flashes of dead blackness could be perceived as the vivid glare subsided momentarily, while so great was the concussion of the booming thunder that the clapboards flapped loosely against the sides of the house.

"Great Scott! this is pretty tough," exclaimed the farmer. "I'll bet all the cream has turned sour. Wonder what time it is."

In order to find out he opened his watch, which, to his extreme disgust, emitted two brilliant flashes and stopped short. Down stairs he hurried, surrounded by little telegraphic dots and dashes of brilliancy, until he reached the parlor. There he struck a match on the wall, and the wall immediately struck back, sending the match flying through the air. Attempts at making light were superfluous, however, as there was a regular electric light plant all over the place. In the glow the clock stood out conspicuous, but it had little information to impart, because its hands were revolving backward at a speed of about a mile a minute. All the metal ornaments in the room had glued themselves tightly to the grate, and the tongs, andirons and other implements, gathered in a mad embrace, were jigging spasmodically round the room. Now, Mr. Emmons is used to thunder storms, but this worried him a little. Instead of abating, the storm seemed to be getting worse and worse. At every shock of thunder the house rocked and swayed as if an earthquake were juggling with it. The farmer stepped to the door just in time to see a playful fork of light go through his pet apple tree, stripping off all the apples and leaves, but leaving intact the branches, the baldest things in the township. A tremendous outburst followed, and then, in a lull, the bleating of the terrified sheep was heard. Mr. Emmons ran down to the field, but was knocked heels over head by the concussion of the thunder. When he got up he saw a huge blade of fire playing around the cherry tree, under which 20 dead sheep were stretched out. Two groups, one of about 10, the other numbering about 30, were scurrying across the field, bleating in terror. The great blade of lightning flashed over the field northward and killed all of the smaller group, after which it burned the fence to ashes and sent forth a report like the explosion of a battery. Its fragments merged into a ball of fire about a foot in diameter, which circled easily around the edge of the pasture, consuming the fence as it went. It was nearing the surviving group of sheep, which was led by a big, wise old ram with considerable strategy in his brains. Seeing the ball approaching, the ram bleated in command, and the sheep followed him to the center of the field, where they huddled together. Slowly the electric sphere went on consuming the fence. This done, it rolled across the field toward the group of sheep. The old ram awaited it with lowered head, bravely sounding his challenge a few feet in front of the group under his protection. Three little lambs, on seeing the lightning approach, broke away from the group and ran to one side. Instantly the ball went rolling and bounding after them. One after another it touched very gently, as if in a game of tag, and one after another they fell. The ball made a wide detour and again approached the group. As it circled, the old ram changed his position, keeping his face toward the enemy. It advanced, and he stood ready to the charge. Then it feinted toward the left and tried to get through on the other side, but the ram's generalship was too good, and the fire ball, but for a swift rise into the air, would have come into collision with that formidable front. The next move of the attacking force was to circle round and round with great rapidity and in narrowing circles, the protector of the flock following every move. Suddenly it shot forward. The ram charged and met it half way. A

terrific explosion followed, and the air was full of fire needles. The flock broke and ran, but the danger was over, for the fragments of the broken ball had darted into the earth, tearing it up for yards around. Half blinded and wholly dazed by the wonders he had seen, Mr. Emmons staggered back into the house.

Next morning he found about 40 dead sheep in the field. Under the cherry tree great furrows had been ploughed in the ground, and for 100 yards round it every growing thing, from the cherry tree to the budding golden rod that lined the fence was withered and dead. All that could be found of the old ram was his horns, so twisted that the farmer is going to have them set in silver for corkscrews. Mr. Emmons collected insurance on his sheep, but the damage to his house is a dead loss. His watch has not gone since, and the parlor clock, while its retrograde speed has decreased, steadfastly refuses to go in the proper direction. Upon every recurrence of the hour of the storm it strikes with the speed of an alarm bell and the force of an anvil.

From other places in the region come accounts of the damage done by the storm, but no other farm suffered as did Mr. Emmons'. The only other experience resembling his is that of Eph Fayman, who, while coming home late, was overtaken by the storm. A bolt of lightning passed so near him that it shaved his left cheek clean, and he has not been able to grow a hair on it since.

## Studies of the Alternate Arc.

H. Gorges in a communication to the Electrotechnic society of Berlin describes the experiments made during the past few years in the works of Siemens & Halske, and Messrs. Oelschlager, Michalke and Queisser. He says we know that with the continuous current the positive carbon develops more heat than the negative. In the case of alternate currents, the carbons are alternately positive and negative, and the luminous intensity is constantly changed from the one to the other. The eye is less sensitive to light variations than to changes in the heat of the arc, through variations of current flow. Above a certain frequency the eye can no longer perceive the oscilliations, while the light may vary materially. The limit of perception is found at about 60 periods per second. The arc inclosed in a ground globe appears more steady than with a clear envelope; while aided by a reflector which, placed above the upper carbon, throws back downward the reflected rays of the lower carbon, blending—breaking the joints, as it were. The eye is unable to detect any wavering at 50 periods per second.[1]

The length of the arc has a decided influence on the amount of light shed with an equal expenditure of energy. The extremities of the carbons are truncated cones, and between the summits of these cones is the arc. This last, then, should not be too short because of the last reflecting surfaces. Yet, on the other hand the heat is necessarily higher inversely as the length of the arc. Fig. 1 shows how the light produced per watt diminishes with the lengthening of the arc. The figures show the length of the arc in millimeters. When the arc is abnormally long the light is of a decided violet hue, the horizontal luminous intensity being quite feeble.

The nature of the arc is dependent largely on the form of the ampere curve. With certain machines we may, by the aid of a simple commutation, modify the curve of the current. In the experiments mentioned below the machine used was tri-phase, arranged for either the star or triangle system of circuits. Taking only a single branch, a flattened curve resulted, Fig. 2, *I*.

Connected in the star form by superposing the currents from two branches a curve was formed closely approaching the sinuisoidal Fig 2, dotted line. Coupling the two branches in opposition the curve produced is that shown in Fig. 2, *II*.

The noise of the arc depends largely on the curve form. The heating and periodic dilatation of the carbons and of the atmosphere produces diverse sounds. With the simple sinusoidal curve the sound is light and the tone pure. Curves of brusque variations give the higher harmonics more or less intense. The sonorous vibration increases with the intensity of the current, the frequency and the length of the arc. Glass globes deaden the sounds materially. On the other hand, with pointed curves the sounds sometimes become very disagreeable. Finally, the nature of the carbons has much influence on the character of the tones.

The voltage of the arc depends on the form of the current. A constant current arc, instantaneously interrupted, re-illumines at once because the heated air is of so high a temperature as to maintain it a sufficient conductor during the short extinction. With an alternate current the voltage should maintain a certain amplitude, because it is reformed after each interruption. It seems established that this value should increase with an enfeebling of the current, and that in consequence the period of cooling should increase. The mean tension, on the contrary, is less with sharp curves than with flat ones.

Authorities have found, for example, that to produce an arc of two millimeter with a sharp curve, 23.5 volts are necessary, and with a flat curve 30.5 volts. The voltage then depends on the form of the current, which does not affect the regulation of the lamp, except so far as this is varied by the changed action of the electro-magnets with the varying forms of currents.

The temperature of the carbons and hence the luminous power, is determined by the electric energy expended in the arc. With high frequencies the quantity of light is probably independent of the form of the current curve. But with the frequencies of common practice the luminous power, according to the researches of Wedding and Roessler, increases with the flattening of the curve. Measurements by the author confirms this result.

From all that has preceded it may be seen that the experimental determination of the variations of light intensity is interesting. Messrs Siemens and Halske two years since conducted a series of experiments in photographic registering, on this line. The apparatus used was a special contrivance, consisting of a disk carrying sensitized paper, mounted either on the arbor of an alternator or a synchronous motor shaft. This disk was inclosed in a dark chamber with a radial slit which could be opened or closed at will. At each new phase of the current a fresh portion of the sensitized paper was presented to the light, so that a distinct record was made of each condition. As the motor was tetrapolar a complete revolution comprised two periods,

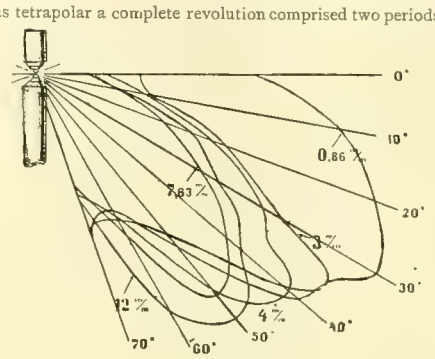



Fig. 1 Variation of Luminous Intensity per Watt, with length of Arc.

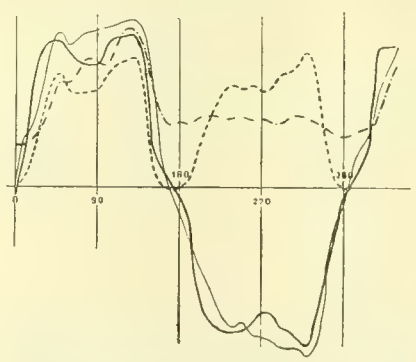



Fig. 3. In this figure current is shown by —, Tension ——, Intensity of illumination .—. Power - - - -. The left portion represents the effect when the lower carbon is positive, the right when the upper carbon is positive

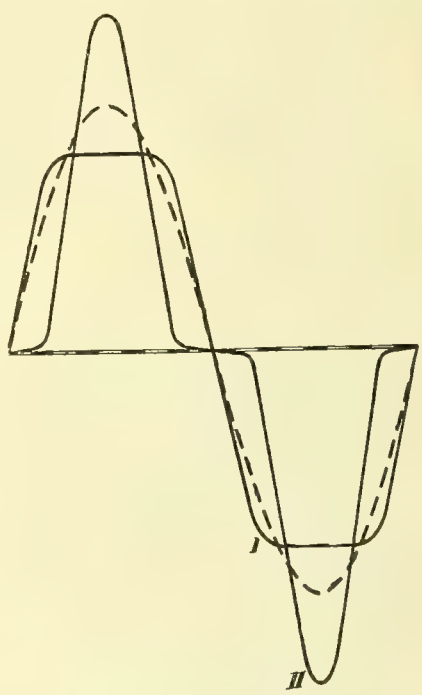



Fig 2. Curves of Currents Employed.



and the annular image presented four maxima of intensity. In the photographs produced direct by the arc, the maxima due to the positive current are markedly more intense than those of the negative current, but when the lamp is inclosed in a globe, with or without a reflector, the two are more nearly equal.

With a small four-pole machine, with six teeth for a period, giving a current of six variations per period, a frequency of 50 periods per second gave 300 oscillations per second. The photograph image clearly depicted all these variations, showing that the light followed, even at this rapid rate, all these changes in current, while the eye at its best could only detect the fluctuations when the periods did not exceed 60 per second.

M. Blondel, in 1891, availed himself of a similar apparatus for the study of the arc. His researches were principally directed to the arc proper, and less toward the radiated light intensity. The line followed was to ascertain if the arc is really broken when the current is passing the zero point.

The registering photograph only gives a qualitative result; but the author sought to measure the instantaneous intensity of the rays, by passing them across a slit in synchronous rotation. The apparatus was simply a disk with two radial slits, mounted on the arbor of a four-pole synchronous motor, and the light passing through these is re-directed into a dark chamber pierced with a straight slit before which is placed an L. Weber photometer.

On the same arbor is mounted the contacts which make the record of the ordinates of the current and potential difference. These contacts charge a mica condenser, and discharge it through a ballistic galvanometer.

To change the phase of the ordinates to be measured, the angle of the slit in the obscure chamber may be changed, but the experimenters have found it easier to change the phase of the motor.

With the apparatus of Oelschlager, changed as suggested by M. Joost—putting the third branch of a tri-phase motor on short circuit upon itself—the experimenters determined the instantaneous value of current intensities of the voltage and luminous intensity for the three types of curves of a tri-phase motor. These results bear the relation of the Figs. 3, 4 and 5.

The luminous intensities were taken at the horizontal line, and at 35° above and below this line. In these last two directions the intensities are equal.

In all the curves we see that the maximum of light due to the negative current is not much above the minima. In the flattened curve we see also that during a long contact with a maximum current, both temperature and light emission are augmented. The difference of phase between tension and current is positive upon the axis of the abscisses, as if produced by self-induction, while between the higher values of the curve this is negative.

The curve of the current appears to be in advance of that of the arc, which is explained by the existence of counter electromotive force (thermo-electric) in the arc, between the carbon and the atmosphere. Thermo-electric forces may, for example, flow from the atmosphere to the carbons. As the maxima are equal, these forces are equal and compensate each other. But now the self induction of the electro-magnets will act, while with the high intensities one of the carbons being hotter than the other, one electromotive force preponderates, and the current is deflected to the left.

In the discussion of the paper Dobrowolsky remarked that the current curve showed no break, and M. Gorges concurred in the opinion that the arc is constant. Prof. Weber demurred. He said much depended on the grade of the carbons.

## Proposed Electrical Section of the British Association.

In commenting on the recent meeting of the British association, the London *Electrician* says: "Probably the hardest worked section is that designated by A, which is devoted to mathematics and physics; and it is a common occurrence, on days when other sections are out at play, for this branch of the association to divide itself into two or even three subsections, each with its own lengthy programme of papers. We are glad to hear there is some idea among those who have the control of such things, of permanently lightening the load on A, by the creation of a distinct electrical section, which should absorb into itself all that is electrotechnical in A, B and G. We sincerely hope this proposed new section may be created; and the earlier it comes into existence, the better will it be for those for whom the chief attractions of the association are electrical. It is a comfort to find this proposal emanating—albeit unofficially—from within the association itself; for we had not dared to make the suggestion ourselves, for fear of being told that electricity was only a branch, indeed a mere sprig, or

1 The optic nerve requires a certain period to receive an impression, and a definite period for releasing it. If the second impression is made before the first is lost, the impression appears continuous. Fire needles are familiar examples.

physics. Under the existing arrangements there is necessity for a high frequency alternating pilgrimage between A and G, the dissipated energy in which is only slightly reduced by the institution of "electrical day" in the latter section. When the amplitude of the oscillations between A and G is large the energy wasted, heat generated, etc., are enormous; and we sincerely hope and with all humility suggest that, at Liverpool, if the new electrical section has not there come into existence, the axis of A and G shall be made as nearly to coincide as the properties of three-dimensional space will permit."

## Methods and Instruments Employed in Climbing Electric Posts.

It is not easy to find, especially in a crowded street, an opportunity to raise an electric post or pole, because of the constantly recurring impediments, such as teams, etc., but anything here said does not apply to street-car people, who often avoid hindrances by doing their work between dark and daylight, or between Saturday and Monday. Even climbing a lot of poles for repairs or construction is a science.

The first implement which naturally suggests itself for such climbing is, of course, a sort of light jackknife ladder. There was a time when a ladder was used and thought well of, but as poles grew some new method was required and adopted.

In the United States the telegraph or telephone man, as well as the electric light man, goes out to fight the conditions with climbers—a pair of stirrups with shafts strapped on to his legs, at the inside bottom of which there are one or two rooster-like spurs, with which he walks up 30 or 60 feet of pole, hugging it like a bear as he rises, fastening himself when up with a body strap, or by straddling a cross arm. They didn't use to do so, especially over the water, but that was before Brennan and Rousseau's time.

In Spain, for instance, along about the fifties, when a telegraph repairer wanted to climb a pole, he made steps as he went, and took them away when he left. Fig. 1 shows how he labored. *P P* represents a section of a pole. The lineman brought with him three, four or more short, light arms *a*, *r*, *b*, each with holes and a string, as shown. As high up as he could reach to mount it he fastened one of these on the pole. Standing on this he raised and tied on another, and so on, until he reached the summit. When his work was finished he took down his little lumber yard, and carried it back to the office, where it is fair to presume he rested till his Bristol sent him out again.

Since 1873 Spanish ingenuity has furnished the climber with an instrument which would be on'y of service in this country in a telegraph museum, alongside of Morse's first instrument or Page's motor.

Fig. 2 shows this later convenience. If the reader desires to buy one, some time when he is in Madrid, he must ask for a *trepadore*, and possibly he would have to take two, as, like most wild things, they come in pairs. In the cut *d* is an iron plate, serving for a foot rest, and *a b c* a curved iron, with sharp projections, as *s*. This curve encircles the pole when the climber climbs, and when he stops

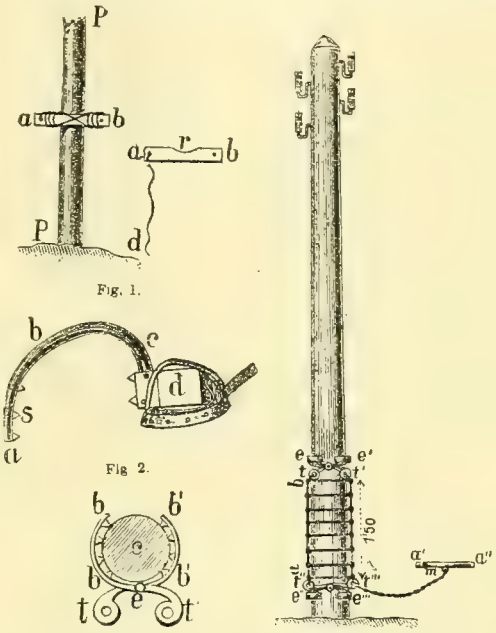



Fig. 1. Fig. 2. Fig. 3. Fig. 4.

METHODS AND INSTRUMENTS EMPLOYED IN CLIMBING ELECTRIC POSTS.

he straps himself to the pole, as is the fashion in the new world.

There are objections to these instruments, according to the *Berne Telegraphic Journal*, inasmuch as they permit the climber to slip if he doesn't stick the spurs in far enough and if he forgets for an instant to keep a proper pressure on the *trepadore*. Worst of all, he is placed in an embarrassing position if from any cause the pole inclines to fall, or, seeing the superintendent of city telegraph coming, a rapid descent is imperative, he can neither climb down, slide, jump or fall, and be sure that he will not land in a heap with his apparatus. The *trepadore* has been responsible for the death of several linemen and tears the posts to pieces. Poles are not so cheap in Spain as in Michigan.

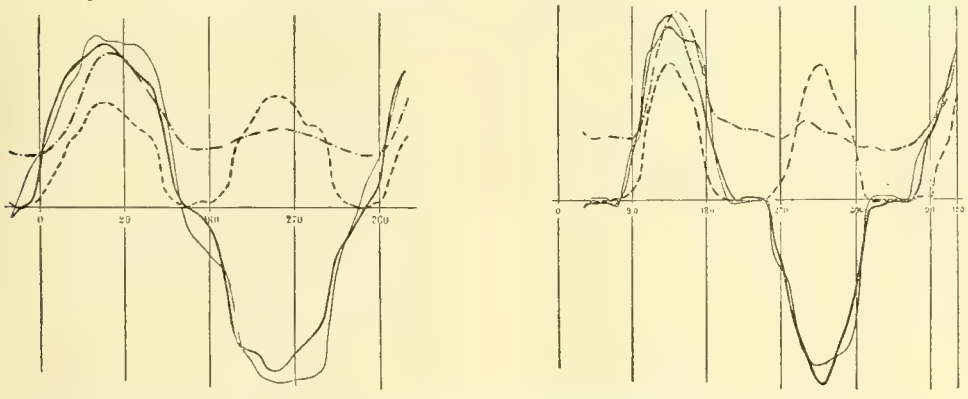
A Spanish engineer has invented a new "pole torturer," which is seen in Fig. 3. Two strong jaws, *b b*, *b' b'*, of wrought-iron move on a center *e*, provided with teeth for biting the pole *c*. The jaws envelop the post. The inventor calls particular attention to the fact that the jaws do not perfectly encircle the pole (as the average small boy in Chicago would say "they bite off more'n they can swallow"), and thus fit all sizes of poles.

There are two holes in the jaws at *t*, *t'*, for attaching a rope or wire ladder. The reader will now watch Figs. 3 and 4, as nearly as possible at the same time, in order to understand the complicated manipulation.

The lineman advances to the foot of the post, and, having attached the ladder to the trepadore *e e'*, *t t'*, he raises the last and applies as much force as possible to bring the jaws together by means of the rings *t t'*, it being understood that the pole has been seized by the jaws.

Now, at the bottom of the ladder is seen a similar pair of jaws—this trepadore also lives in pairs—and this is raised up to within a short distance of the first named, and fastened while the safety strap holds the lineman. Then the first trepador is pulled up another hitch. The motion is much like that of a measuring worm on a raspberry bush, but not quite so rapid.

It is, perhaps, unnecessary to state that when the lineman has done his work, he returns in reversed order, especially if he misses his hold, which it would appear is quite as likely to happen with this as in the case objected to a few paragraphs back. The trepadore is not likely to invade Cook county. Neither John Burke nor Ed Carroll take kindly to it, and Yerkes' men do their climbing with a wagon.




FIGS. 4 AND 5. STUDIES OF THE ALTERNATE ARC.

## Appeal in the Double-carbon Suit.

The argument before the United States Circuit of Appeals on the appeal in the double-carbon arc lamp litigation has been set down for November 7th. Judge Showalter decided that the Scribner lamp of the Western Electric company did not infringe the Brush double-carbon patent, and the Brush company appealed the case. The appellant will be represented by H. H. Seymour and Wm. B. Bolton and the respondent by Barton & Brown. Judges Woods, Jenkins and Bunn constitute the court.

## Wanted: A Talk-meter for Telephones.

"A crying need in the telephone business," said J. R. Malloy, of the Central Pennsylvania Telephone company, after an examination of the Washington telephone exchange, "is a talk-meter; that is, some sort of an automatic arrangement by which language can be measured off by the yard. Philadelphia is approaching the idea. The Bell Telephone company there gives what is called measured service rates, the 'measurement' being determined by the number of calls or connections, each five minutes' conversation or fraction thereof being counted a call. This gives subscribers rates in proportion to the use of their instruments. The city service recently introduced there is very much upon the principle of the long distance service between cities."

"Do you consider this an advantage over the old systems?" he was asked.

"Well, it is not perfect," he replied. "What is required is a regular 'gas'-meter, with a stop cock for profanity, old jokes, and endearing names for the telephone girls. I think an arrangement of this sort would be more valuable than an automatic device for making the connections. Many a wordy tale would be cut short, many a delicious but unprofitable confab nipped in the bud. If Ida at one end of the line knew that she was keeping the tantalizing secret from Charlie at the other end, at a rate of 10 cents for every five minutes, she would disclose it more quickly and give the woman who wants to telephone for the doctor a chance at the line. Some method will have to be adopted to stop the effusive conversation over the wires. Seven hundred and fifty million telephone messages were sent over the wires last year, averaging about ten messages to every man, woman and child in the United States. Telegrams never exceeded one per head per year, which shows that the telephone system may eventually entirely supersede the telegraph. In 1885 there was only one long distance line extending between Philadelphia and New York. To-day the system has 265,000 miles of wire and $77,500,000 is the estimated investment in telephone property. A comfortable share of the telephone investment would go to the man who would invent a talk-meter."

## The Telephotograph.

The telephotograph is the name of a new Swedish invention, which is claimed to do for the eye something like what the telephone does for the ear. It is based upon the peculiarity of selenium, that its resistance to the transmission of electricity to a great extent depends upon the strength of the light to which it is exposed. The construction of the telephotograph is simple enough. A fine point of selenium is made to move in a plane by a mechanical arrangement in such a manner that it, moving within a limited compass of this plane, repeatedly forward and backward, describes a spiral consisting of very close windings. An electric current passes through the selenium point, and the power of this current will vary according to the light to which the point at any given moment is exposed. The receiver is constructed in a similar manner to the above, except that a very susceptible incandescent light has been substituted for the selenium point. The intensity of this light varies in harmony with the light to which the selenium point is exposed. When the incandescent light is made to move in a similar manner to the movements of the selenium point, it will produce lights and shadows on the plane similar to those through which the selenium point passes in its plane. The dispatching apparatus is inclosed in a case, something like a photographic camera, fitted with an objective, which can be so adjusted that the picture of the subject to be telephotographed is formed in the movement plane of the selenium point. The lights and shadows produced by the incandescent light of the receiving apparatus will then produce a picture identical with the one at the dispatching station. This picture can be made visible in various manners, either through photography or by being directly looked at through some magnifier, or in a similar manner to the one used in a magic lantern. The rapidity of the movements of the selenium point through any one point of the picture must not allow of a greater interval than about one-eighth of a second, so that the corresponding impressions upon the eye of the beholder form a continuous complete picture.

## Large Isolated Plant in Buffalo.

One of the largest isolated electric lighting plants in the country is being installed in Ellicott Square, Buffalo's great office building, by the Louis K. Comstock company of Chicago. It is claimed that this structure, now nearing completion, is the largest office building in the United States. The ground dimensions are 240 by 200 feet, giving twice the area of the Monadnock building, Chicago. The building is 10 stories high and will contain 40 stores, 16 counting rooms and 600 offices, costing $3,350,000. It fronts on Main street and three other streets and was planned by D. H. Burnham & Co. of Chicago. The lighting plant will consist of four engine-dynamos—Ball & Wood engines directly coupled to General Electric 100 kilowatt multipolar dynamos—and about 8,000 lamps will be connected with the switchboard.

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NEVER before in the history of the storage battery business of this country has there been so much interest displayed in the work and promise of that field. Some continue to doubt the commercial utility of the accumulator, but generally speaking the storage battery people have gained the attention of the public, and it rests entirely with themselves whether they will also gain their confidence. Central station men are beginning to look with favor upon the use of storage batteries as auxiliaries, and managers of street railways are likewise interested in this feature of the business. Commercially considered, the outlook for the storage battery is by far much brighter than ever before in this country.

A THRIFTY schemer is John P. Barrett. His experience has gotten him into the habit of demanding his compensation in advance. Knowing full well that the publication of his name as one of the judges of the motocycle contest must make that undertaking a failure, he secured the publication in advance of an "interview" in Mr. Kohlsaat's evening paper in which he was referred to as an "expert" and a leader among electrical men. Of course, he knew that Mr. Kohlsaat would not print such stuff after the contest. He knew that that event would show pretty clearly that he had no standing as an electrical engineer or electrician; that he was regarded as a politician, and was looked upon with distrust, and he must have known, too, that Mr. Kohlsaat would entertain the same feeling after a short experience with him. It was doubtless for this reason that the "professor" deemed it wise to secure in advance whatever compensation he could get for his services.

AS MIGHT have been expected, the motocycle contest announced for Saturday, November 2d, at Chicago, did not take place. It was too much to expect that any enterprise with which Barrett and Hornsby were connected could be successful. The appointment of this precious pair precluded any "contest," and the electrical interests, knowing full well what a farce anything conducted by the "professor" and the "doctor" must be, withdrew in disgust. They had not forgotten the World's Fair. We are sorry for Mr. Kohlsaat, for it appears that he appointed Barrett thinking that the "professor" had the confidence and respect of the electrical fraternity. Of course Barrett couldn't get along without Hornsby, and thus the project was doubly doomed.

LONDON capitalists interested in the Brazilian Submarine Telegraph company have very graciously announced that so far as they are concerned they would not object to Brazil possessing the island of Trinidad if she permitted their company to use it as a telegraph station. At a recent meeting of the directors of the company at London Sir John Pender said the position of the company in its dealings with the Brazilian government was unsatisfactory. Brazil, he thonght, ought to have treated this pioneer company better, since it had helped to build up Brazilian trade by bringing the country into cable relations with the rest of the world. It was when the company had found that Brazil would not deal fairly that it had tried to carry on traffic with the Argentine Republic. It had laid a cable across the Andes with the West Brazilian company, and to prevent Brazil from interfering with that traffic had looked out for a fresh station, and had pitched upon the island of Trinidad, which was not occupied and was an excellent station. Now the company is confronted with the claim of Brazil and the Englishmen are exceedingly wrathy over this turn of affairs.

THE latest departure from time-honored practices of street railway companies the country over which the Chicago General Railway company has introduced is the plan of purchasing or condemning its routes through private property instead of asking the city to grant the use of the streets for the purpose of establishing its lines. This applies only to outlying territory where property is sufficiently cheap to warrant this method of acquiring right of way. In the more thickly settled parts of the city, and especially in its proposed downtown routes, the General Railway company will still adhere to the use of streets. So far as the new plan applies the company will have an advantage over other companies in that it will be perfectly independent of the aldermen and the public, too, for that matter, in a limited sense. It will be on the same footing as the steam lines; it will not be subjected to annoyance from political hacks and it will be permitted to conduct its business without interference or restrictions by the city council. No doubt this action will have a far-reaching influence and one that street railway men may not entirely welcome. If the new company succeeds it will prove conclusively that the franchises held by street railway companies, generally speaking, are much more valuable properties than they are usually admitted to be and the companies that apply for grants of this kind in the future may be compelled to pay a reasonable sum for the privileges extended by municipalities.

TOO MANY accidents have been reported since the introduction of the trolley upon the lines of the Chicago street railway companies. Some of these have been the result of carelessness on the part of the motormen, but these have been comparatively few, and none of them has resulted from defects in the system itself or in the failure of the apparatus. It is worthy of note, too, that very few accidents have happened in crowded streets, which of itself is ample evidence of the superiority of the system itself. In most of the cases reported in the daily papers it is evident the victims were either entirely to blame or they were guilty of contributory negligence. It is a well established fact that so far as the trolley itself is concerned there is very little if any reason for objection, and in view of surrounding conditions and the vast benefits it bestows, its record is admirable. But this is not all. Too many accidents have happened upon these trolley roads. It is the duty of the companies operating them, of the city officials and the people to see to it that these accidents grow less frequent. This can be accomplished by the company first of all employing competent men on all its lines and requiring the exercise of greater vigilance on the part of its employes, by the city officials co-operating with the railway companies in the enforcement of the ordinances relating to the obstruction of the tracks, and prohibiting children jumping on and off cars moving at a high rate of speed, and the exercise of a greater degree of care on the part of the patrons of the company and the public generally. All of these requirements must be met if the operation of the trolley lines is not to be accompanied by fatalities like those that have marred the record of the Brooklyn companies. We repeat there are altogether too many accidents, and there is no occasion for a continuance of this condition of affairs.

EXPERT opinion upon electrical and mechanical questions should always be secured by persons who contemplate investing in enterprises of this character with which they are not familiar. The services of a competent electrical engineer can be obtained for a reasonable consideration to look into the value of a project of this kind, and a few hundred dollars thus invested will often save many thousand dollars. A contemporary, discussing this subject, calls particular attention to the fact that the intending investor in electrical transmission plants, where water power is the initial source of energy, as well as the prospective user of such transmitted power, should carefully investigate the permanency and reliability of the water supply. A late example of the results of disregarding this plan is furnished by the Hillgrove & Armidale Water Power Electric company of New South Wales, which, after putting in a plant costing over $125,000, and making agreements to supply the mining companies in the district with power, was unable to carry out its contracts, owing to the failure of the water supply. This unusual condition was due to the fact that the last season was the driest known there for twenty years, but dry seasons must be expected and provided for, as power will be just as necessary then as at any other time. It is suggested that if the possibility of obtaining fuel and other local conditions will permit it, a plant of this kind should be supplied with a steam relay of a capacity equal to at least one-half the normal water power capacity.

THE belief seems to be pretty general that electric propulsion in some form will soon be adopted upon the Erie canal, and the friends of that great waterway are using every effort to take advantage of the present interest in the projects under consideration to secure favors from the Legislature. One measure proposed is the bonding of the state for $9,000,000 to begin the work of deepening and widening the canal so as to get the best possible results from the adoption of electric propulsion. The issuing of these bonds was one of the questions voted upon at the election on Tuesday. The measure has been vigorously opposed, and it has been pointed out that some years hence, with electricity as the motive power, the full capacity of the Erie canal may be reached. When that point is attained, it is contended, the question of deepening and enlarging the canal, or constructing a ship canal, can be brought up for discussion and decision. The advocates of the measure pronounce this a short-sighted policy, but on the other hand it is pointed out that no one pretends that the improvement contemplated could be carried through for nine millions. It might cost twenty millions or thirty millions or forty millions. Nobody knows what the cost would be, but all are agreed that with the introduction of electricity the capacity of the canal will be greatly enlarged, and that for several years, with electricity as a motive power, there will be no pressing demand for enlargement of the canal.

IN a recent address upon the progress of the temperance movement Miss Willard said that "men who drink liquor take less of it, and that more men do not drink at all, than in any previous year," and she explained this by saying that the advancement in industrial development had an elevating influence upon men's minds. "Steam and electricity, machinery and invention, have put level heads at a premium." This is a concise statement of the situation to-day, and every employer of large numbers of men will corroborate this assertion. It is estimated that at least one million men are employed by railroad companies in various capacities. Upon each and every one of them in a measure rests responsibility for life and property, and as the duties are of such an exacting nature they can only be performed by men possessing clear heads. The same rule applies in other great industrial organizations. A better class of men are required for the handling of electric cars than were formerly employed as drivers when animal power was used. The application of electricity to commercial and domestic uses has created a demand for skilled workmen possessing clear heads and steady hands to perform the work of construction and operation with precision. Miss Willards conviction that there is a decrease in intemperance is shared by many others. The best evidence of the correctness of this position is found in the fact that the consumption of spirituous liquors during the last fifty years has not increased in proportion to the increase in population. We do not doubt that much of the credit of this improvement is due to the fact that discrimination is made against men of drinking habits to-day. Of course many other conditions have contributed to this general improvement, but there is positive proof that the general introduction of electricity and machinery has been followed by increased sobriety among men engaged in such industries employing.

## Storage Batteries for Railways.

By Maurice Barnett.

In these days when it is the practice of not a few eminent electrical engineers to damn the storage battery in the field of traction, either by too vehement denunciation or by "too faint praise," the announcement in the *Kolnische Zeitung*, that the trolley system which has been in use in Hanover for some time has been discarded, and that the 28 cars operated on that system are to be remodeled and equipped with storage batteries, while not conveying solace to the electrical engineers referred to, will prove very gratifying to those who, even in view of some discouraging failures in accumulator traction, have always had a firm conviction that traction work was a legitimate field for accumulators, and that the test of time would prove that storage batteries would be able to hold their own with other representative electric traction systems.

Since the announcement in the *Kolnische Zeitung*, news has been received here that the Dresden Tramway company and the Hague Tramway Maatschappy have likewise decided in favor of accumulator traction. Inasmuch as no less important a company than the Tudor Storage Battery company is making the installation, it is not at all too optimistic to believe in the ultimate success of the storage battery cars about to be operated in the places named.

Up to the present time the engineers of the overhead system have had matters pretty much their own way. Occasionally a statement of results (coming in all probability from interested sources) bearing upon the success obtained with the open conduit has caused a commotion in the trolley ranks, but, save for that, the erection of poles has gone merrily on and the manufacturers of trolley machinery have had no complaints to offer on the ground of lack of orders. The last two months, however, have seen the beginning of a mighty change. To-day the trolley is considered to have been merely coincident with the evolution of the modern passenger railway, and its usefulness in the future, at least in cities, is not likely to be greatly overestimated. E. H. Johnson, who, with Lieutenant F. J. Sprague, was the pioneer in working out the trolley method of electric transportation, writing in the *Electrical Engineer* under date of October 9th, sounds the doom of the overhead line, at least in cities and towns. The reason for this belief is to be found in the objection to overhead construction and secondly in the fact that greater economies are possible in the newly projected closed conduit system, by reason of the fact that higher voltage may be maintained than is practicable in trolley systems. This criticism, emanating from one of the parents of the overhead wire system, may be considered to have some weight. Mr. Johnson also proceeds to pay his respects to the open conduit system, anent the great ado made by the Metropolitan Traction company of New York, "over the practical success of their $150,000 per mile open conduit system," by saying, "it was neither scientific nor business-like to place the electrical conductors in a sewer and then expend hundreds of thousands of dollars to secure drainage." This represents the view that is at present held respecting the open conduit electric system. Surely the friends of the electric accumulator can take hope in the discomfiture of their rivals.

Looking impartially at this question, it would seem as if the contest for the supremacy in the field of transportation would in the future, be between the storage battery and the closed conduit system. Which side will win cannot be conjectured at the present time. Neither system is in the final form it will assume when the contest for supremacy takes place, and one is therefore precluded from indulging in prognostications regarding the outcome.

The above remarks have been called forth by statements appearing from time to time in some of the newer electrical journals, reflecting upon the judgment of those who are instituting the test with storage battery cars on the Madison avenue line in New York city. The remarks have all been characterized by a sneering incredulity as to the value of accumulators for traction work. Before the next six months are passed, the critics of the storage battery system may have to reverse their conclusions.

The object of the present paper is to emphasize the great value possessed by storage batteries, not in furnishing direct motive power, but when used in connection with railway power plants.

The first accumulators used in connection with a railway power station were, so far as the writer can ascertain, those employed in the power plant of the railway lying between Zurich and Hirslanden, Switzerland, an account of which was published in the *Elektrotechnische Zeitschrift* of June 28, 1894. According to report the dynamo delivers current under a constant load, the accumulators being charged or discharged as load on the line is less or greater than the output of the dynamo. In this plant there were automatic means for cutting in and out of end cells to keep the voltage constant. Results showed that by means of the accumulators a saving was effected of 2 2 pounds of coal per hour, amounting to nearly a ton per day, or $2,500 a year. The cost of accumulators, installed complete with necessary apparatus, was $7,400. Allowing for interest and depreciation, the battery paid for itself in four years, by saving in coal bills alone. The saving was effected by reason of there being no necessity to keep a second boiler and steam engine in reserve, and that by this arrangement the power plant ran at its highest efficiency. It was furthermore developed that the first cost of combined steam power and battery plant was less than the cost of total steam power plant would have been for the same work.

How important this installation proved may be judged from the fact that a single type of storage battery is now found in Germany and Au-tria, in 80 per cent. of all central stations, besides being installed in 15 railway power plants and 5,000 isolated lighting plants.

Two railways in the United Kingdom have recently attracted a great deal of attention; and inasmuch as the batteries used in connection with generators are of the chloride accumulator type, manufactured by the Chloride Electrical Storage Syndicate, Limited, the installations have a special interest for American railway managers. These two railways are known as the "Douglas Laxey line" and the "Snaefell Mountain electric tramway," both in the Isle of Man.

The Douglas-Laxey line was established about a year ago. From *Lightning*, London, September 19, 1895, it is gathered that when the battery was connected to the line the cars immediately began to run with exceptional smoothness—the accumulators keeping the voltage steady and eliminating all sudden variations due to starting of other cars. How variations would otherwise arise will be understood when it is considered that it requires 150 amperes at 500 volts to carry a loaded car up the 8½ per cent. grade at a nine mile rate.

Encouraged by the success attained by the Douglas-Laxey electric tramway, which, after a year of service, "had fulfilled in every way the expectation of its promoters," it was not difficult to secure capital to construct an extension of this road up to the summit of Mount Snaefell. The electric equipment of the Snaefell road resembles that of the Douglas-Laxey line, both being designed by no less eminent an engineer than Dr. Edward Hopkinson. The battery consisted of 246 special cells. At 550 volts, battery furnished 176 amperes for three hours, 112 amperes for six hours, 84 amperes for nine hours and 72 amperes for 12 hours.

By evening up the load on the generators, the battery enabled the plant to work at a high efficiency and rendered the service extremely satisfactory.

A large economy is made possible by a special use of battery at seasons of the year when there is comparatively little traffic. Under the agreement with the authorities, these lines bound themselves to run two cars a day each way every day of the year. Obviously, it would not have paid to keep the power house in operation just for this load. This is where the battery proves so valuable during the winter months. The battery being charged once a week can carry the load for the other six days without necessitating the running of the power plant.

In the United States there are two installations of storage batteries in connection with railway power plants which are of special interest. The first is at Merrill, Wisconsin, where a battery of chloride accumulators was installed to effect a solution of the problem so constantly occurring in the railway world, *i. e.*, how to bring up the capacity of the power plant to meet the requirements of a constantly increasing demand. It was decided to use a battery not alone for increasing the light capacity, but for regulating the voltage on the railway circuit, which, according to the engineer who installed the plant, "was far from satisfactory owing to the great fluctuations in railway demand." As the lighting machine and railway generator were connected to the same shaft, it can be understood that the light furnished was far from satisfactory. Records kept before the battery was installed showed a fluctuation as high as nine volts on each side of the three wire system. Herbert Condict, in a paper descriptive of this plant, read before the Northwest Electrical association at a recent convention, spoke of the performance of this battery as follows: "The great improvement in running of cars was immediately noticed by all, but it was at night that the contrast was most apparent. The two water wheels were connected together as usual, but the railway generator charged the battery at almost a steady rate instead of with its ever varying demand of from 0 to 120 amperes per car. * * * Instead of a succession of sharp peaks the voltage curve of the lighting circuit became practically a straight line; instead of nine volts variation, there was practically no variation, demonstrating most clearly the capability of the battery to respond to all demands of the railway, matter how severe."

The second plant mentioned is now being installed at Anaconda, Montana, for the Electric Railway, Light & Power company of that place. The battery consists of 270 special cells of central station type of 600 ampere hours' capacity, but admitting of very heavy discharges. The object of the battery is to even up the load on generators and maintain constant electromotive force. When the battery goes into operation it will be found to give results no less satisfactory than those obtained with the Merrill patent.

To sum up, it may be said that the storage battery is destined to play a very important part in the future in light, heat and power stations. The reason for this statement is to be found in the ability of a good storage battery to act—

First—As a "reservoir" in which may be stored up the energy representing the difference between the average and the maximum demand on a generating plant.

Second—As a regulator of pressure on circuits subject to fluctuating demands—increasing the efficiency of the service and diminishing the wear and tear on apparatus; and,

Third—As a "transformer," to utilize high voltage charging currents and to discharge, when disconnected from generator, at any lower voltage desired.

One fact that has been demonstrated, and which has the most important bearing on the construction of electric railway power plants, or for that matter of most electric light or power stations, is that in any station which has to meet a fluctuating demand for power, a plant consisting of part steam power and part storage battery is cheaper in first cost than a total steam power plant would be for the same work. The high efficiency and satisfactory performance of such a plant have already been referred to.

## Influence of Cold on Magnetism.

At a meeting of the Paris Academy of Science some months ago Raoul Pictet described some experiments which he had been conducting with a view to determining the influence of low temperature on the power of attraction of permanent magnets. The magnet employed was an old one of horse-shoe shape, and formed of three pieces. It weighed 493.5 grammes. At one time in its history it could support 4,275 grammes; but having been left without its armature attached for some years, it could only support 3,226.5 grammes. After describing the details of the arrangement by means of which the temperature of the magnet was lowered, the mean results of four sets of experiments are given at temperatures ranging from + 30° C. to — 105° C. From these the *Electrical Review* of London selects the following:

| Temperature of the magnet | Force of magnetic attraction. |
|---|---|
| + 30° C. | 57.31 grammes |
| + 20° C. | 58 48 " |
| + 10° C. | 59.81 " |
| ± 0° C. | 61.04 " |
| — 10° C. | 62.42 " |
| — 20° C. | 63.93 " |
| — 40° C. | 66.70 " |
| — 80° C. | 72.70 " |
| — 100° C. | 75.80 " |
| — 105° C. | 76.64 " |

M. Pictet closes his paper abruptly, and does not suggest that there is any relation shown between the values for the force and the temperature at which it was determined.

## Underground System Not Favored in Boston.

According to present indications it will be some time before any other than the trolley system will be used by the West End Street Railway company of Boston. President Little has gone on record in an interview as having but little faith in the underground conduit for electrical transmission, and despite the alleged success attending the installation of the underground conduit system on the Metropolitan Traction company's Lenox avenue line in New York, asserts that not until it can be fully demonstrated that this system is in every way practical will he or the other officers of the West End company give it serious consideration. "No line can afford to experiment with underground conduits on its main line, owing to the possibility of failure and the attendant disorganization of that part of the road where the trial is being made," says President Little. "All tests of this character should be made on small lines built especially for the purpose in some outlying district. The West End is carefully following the new inventions in this field of electrical development and through its specially appointed engineers is kept fully acquainted with the advancement made. When it shall have been clearly demonstrated that the current can be taken from a conduit underneath the cars, keeping in view the economic phases of the question, then I will be only too happy to make a change, but until that time arrives the trolley will be in use in Boston. I well remember when the storage battery was introduced on the Fourth avenue line in New York and the great anticipations indulged in by the inventor. It was said at the time that the problem of electrical propulsion had been fully solved and that in the course of a few years every street railway line would find it neccessary to adopt it. But we all know the failure of this tentative trial. Rest assured that I am looking out for the interest of the West End company, and

that as soon as it can be shown that we can do away with the unsightly overhead system, the wires will come down with a rush." It is not to be wondered that the West End officials desire to pursue a conservative course. In the early days of the application of electricity to street cars the West End experimented with conduits, with the result that thousands of dollars were expended and the system finally discarded as impracticable.

## The True Position of the Business Paper.

By N. C. Fowler, Jr.

The trade paper is a trade necessity. Business may be run without it. Business never has been run without it. The merchant can write his letters on a barrel-head—but he doesn't. Merchandise can be sent across the continent by mule power, but nobody uses that motor.

The fact that every trade has from one to a dozen representative papers devoted exclusively to the trade they represent is *prima facie* as well as circumstantial evidence that the trade paper is a part of the economy of business.

I don't own a trade paper. I never did own a trade paper. I never expect to own a trade paper. I have no trade paper interest. I simply know trade papers. I am writing what I know.

A bank president in Boston can't write more than his name, but his ignorance didn't make him a bank president. There are men who don't read the trade papers and succeed, but so long as the ninety-and-nine read trade papers, and are successful, there is no need of discussing the peculiar composition of the one man who makes money and reads nothing.

The trade paper is a commercial clearing house, with members entirely confined to its particular trade. It is more than a clearing house; it is a typographical business club, and into its arena is thrown the thought of trade. It is a printed show-room, where everything new and everything interesting are placed before the reader for the reader's benefit.

The good trade paper civilizes trade—spreads trade—increases trade—makes trade honest—disarms unnatural competition—tends to raise cold-blooded business up to the fraternity of social decency. The man who reads a trade paper may not be wise, but I never knew a fool to read a trade paper. The trade paper reaches into general trade, and absorbs that line of business which is pertinent to the class it illustrates. The trade paper gives to the reader that which he wants; it is a sort of sieve through which only can pass words of business interest.

The reason that trade papers carry advertising is the same reason that magazines and daily papers carry advertising. The first-class trade paper has just as much right to devote a part of its pages to advertising as has the magazine or story publication. The advertising in a trade paper is as interesting as the reading matter, for the advertising pages present the names and addresses and other business information concerning the most enterprising business men in the trade represented.

A man can do business without advertising in the trade paper, but the fact that comparatively few men of enterprise do not advertise indicates that the advertisement in the trade paper has money-bringing and trade-increasing value. The progressive manufacturer wholesaler or realizes that while the circulation of the trade paper may be small, every copy goes into the hands of a probable customer. A paper with a circulation among 1,000 probable customers is worth more than the circulation of a paper with 100,000 among possible customers, unless the 1,000 probable customers are included in the 100,000 possible customers.

The only people who read an electrical journal are those interested in electricity or electro-technics—mainly those who earn their living making, distributing and retailing one particular line of goods. They are not only interested in the news of their trade, but they are ever anxious of considing anyone who supplies the goods they sell. The advertisement in the trade paper may not bring more than one answer a month, perhaps not more than one a year, but one answer may be the beginning of a trade which will pay for the advertisement ten times over.

There are a thousand reasons why a general magazine need not be read by business men, but the sun never shown upon a reason why the man who sells electrical goods should not read systematically and carefully the paper which represents the trade of his living. He reads the trade paper, and, as he isn't a fool, he reads the advertising pages as care fully as he reads the reading matter, for the business man knows that the advertising pages will present to him ways and means of increasing his business, and of making more money.

The man who does not believe that people read trade paper advertisements is advised to print at the bottom of his advertisement, in the smallest possible type, the statement that he will present a yellow dog, or a rosewood piano, to any reader of the paper who sends for it.

The best advertising in the world is the advertising that strikes men squarely between the business eyes.

The trade paper contains nothing but business; it is the one great business-bringer of wholesale publicity.

There is something the matter with the business man who can't build business better with the business assistance of business papers.

## Card's Improved Fuse Box for Street Railways.

In street railway service the fuse box is a necessary part of each car equipment and should receive the careful attention of every street railway company. The success of any system depends largely on the completeness of minor parts and the readiness with which they perform their part of the work.

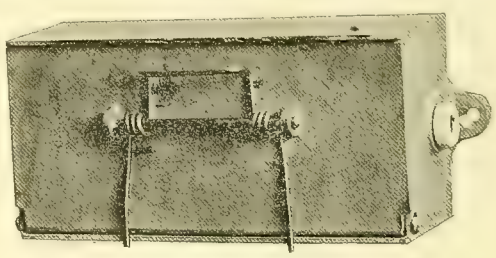
The accompanying cuts show Card's improved fuse box

BRYANT'S THREE-EIGHTHS INCH SOCKET.

for street railways, manufactured by the Card Electric company, Mansfield, O.

Fig. 1 shows the slate box without metal case and is well adapted for use on cars when placed under the seat in or some other protected place. It is made up with slate bottom and sides, and has brass binding blocks at each end for securing the connecting wire. At one end is a small spool, on which is wound a length of the fuse wire selected. The wire passes from the spool under a clamping piece on the binding block, through a slot in the slate partition and under another clamp on the opposite binding block, completing the circuit.

Fig. 2 shows the slate box in a metal case for use on the outside of cars. The lid closes tightly and the box has a projection along the top, making it water and snow-proof.



FIGS. 1 AND 2. CARD'S IMPROVED FUSE BOX FOR STREET RAILWAYS.

A folded piece of asbestos slips inside the box along the sides over the fuse, insulating the lid.

Fig. 3 shows the box with the front open, exposing the fuse. The spring on the outside of the lid acts to hold it either closed or open.

When a fuse blows all that is necessary to do is to loosen the thumb screws, pull through more wire and clamp it down. No hunting for wire never found and no time lost. Each spool will hold 35 feet of No. 21 copper wire, enough for 100 fifty ampere fuses. When the wire is used up the empty spool can be taken out and a full one put in without loss of time. As the proper size of wire to use depends largely on the grades, service and the motors, it should be determined by the superintendent and then adhered to. This method will save burn-outs, time and money. It is not safe to permit motormen or conductors to select their own fuse wires, since the temptation is great to put in a large one and save themselves the trouble of frequent renewals.

## Bryant's Three-eighths Inch Socket.

The necessity for heavier arms than are used in ordinary chandeliers, especially in street lights, has created a demand for a socket with a cap or base large enough for a three eighth inch pipe. This demand has been met by the Bryant Electric company, as shown. A new catalogue has been recently issued by this company.

## Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The Northwestern Telephone exchange is rebuilding its Mankato, Minn., exchange and extending a line to Lake Crystal, Minn. The Phœnix Telephone company, which recently secured a franchise at Mankato, contemplates extending a line to Lake Crystal.

The Mercer County Telephone company has decided to extend its line from Reynolds, Ill., to Rock Island, where it will connect with the Bell system.

The Iowa Union Telephone company is centralizing telephone lines at Decorah, and connection with Ridgway, Fort Atkinson, Spillville, Calmar, Ossian and Castalia, now directly connected with West Union, will be transferred to Decorah. A line to Burr Oak is agreed upon. It is understood that this is but the beginning of a system that will in time cover all the towns in the north of the county.

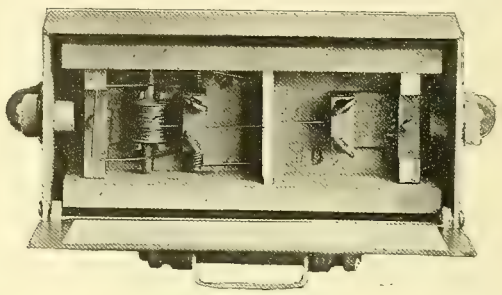


FIG. 3. CARD'S IMPROVED FUSE BOX FOR STREET RAILWAYS.

W. C. Swift of St. Paul is negotiating with Grand Rapids, Minn., citizens to put in a telephone system. A system was put in a year ago, and was paid for in notes which are held by the Bank of Minneapolis. The system was not a success and the notes are not paid. The bank offers to put in a central system if the notes will be paid.

# CORRESPONDENCE.

## New York Notes.

New York, November 2.—Now that the Court of Appeals has decided that the newly annexed district is part of New York city, the Postoffice department is preparing togive regular and improved postal service. It is probable that the trolley lines radiating into the new region from West Farms will be utilized in the distribution of the mails. This will depend, perhaps, somewhat upon the success attendant upon the new postal cars of the Third avenue cable road. It will be a very simple matter to attach such cars as trailers to the trolley cars on the Union railway, and there will be a good deal more time between stations for the distribution of mail on board the postal cars.

The chroniclers of the *Sun* are ever on the lookout for "the quaint, the queer, the quizzical." The trolley cars of Newark afford them opportunity for somewhat fanciful writing. Here are two examples:

Newarkers of both sexes have changed greatly in manner and expression within a few years. They are much more agile than they were and wear a scared look which has been mistaken for the effect of riding the bicycle. It is the trolley face, which, with the accompanying agility, is produced by the clang of the trolley-car gong. There is one place where the cars have to wait their turns in crossing the street. It is in the business center of the city where nearly every line passes the junction of two streets. Sometimes there will be as many as 30 cars waiting for an opportunity to cross or turn the corner. It requires three policemen and three

employes of the traction company to keep the cars moving and prevent the people from getting under the wheels.

They have all-night trolley cars in Newark now, one on each line, making a trip every hour. The traction companies fought against their introduction, and put their objection on a purely moral basis. They said that people staid up too late, anyhow, and if all-night cars were put on a lot of them wouldn't go home at all. The people said that the real reason could be found in the fact that the cars would not pay, but they clamored for them until they got them. The companies drew the line at Newarkers, however, and said that they might go to perdition at the speed of 12 miles an hour, but the managers of the road would not be responsible for the downfall of any suburbanites, and consequently the late cars do not run beyond the city limits.

Very seldom does the element of romance appear in the life of the average electrical worker, but one of these instances is noted in the marriage of John Blair and Miss Leonie Neill, which took place recently at Milford, Pa., and which was the sequel to an acquaintance over the telephone. Mr. Blair has been employed for the last year in the superintendent's bureau in the main office of the New York and New Jersey Telephone company in Sixth avenue, Brooklyn, and Miss Neill, for about the same time, has been the chief operator in another department in the same building. A few months ago Mr. Blair and Miss Neill had occasion to speak over the telephone, and although they had never met they were mutually attracted. The acquaintance quickly developed into an engagement.

During the recent cold snap there was much complaint against those surface railway superintendents who had the hardihood to send out open cars in both New York and Brooklyn, thus exposing thousands to colds and other ailments which are apt to come with an unseasonable fall in temperature at a time when people are not prepared for it. In Brooklyn Health Commissioner Emery sharply reminded the railroad companies of the ordinance prohibiting the use of open cars when the temperature is below 60 degrees. As the mercury barely touched 60 degrees at any time on one of these days, there is a probability that the officials responsible for thus imperiling the health and perhaps the lives of large numbers of travelers will not escape with a simple reprimand and reminder that they have violated a city ordinance.

Labor leaders have been secretly at work reorganizing the surface railroad employes, and unions have been started on most of the New York lines and the consolidated roads of New Jersey. Few meetings have been held, as the men feared that they would be discharged if it were known. The organization is said to be furthest advanced on the Forty-Second street line. The greatest difficulty has been experienced by the organizers on the lines of the Metropolitan Traction company. The officials of that company have tried to head off such a movement by establishing a club for their employes. A number of men have been discharged from the Broadway, Twenty-third street and Christopher street lines because they were union men. W. F. O.

## New England News.

BOSTON, November 1.—The city government of Boston (both branches) has adopted an order, which, if approved by the state legislature, will very materially affect the dividends of the West End Street Railroad company of this city. The resolution requests the mayor to petition the next General Court for the passage of an act compelling street railway companies operating in Boston to pay a tax of $25 for each car per annum and also to take care of the streets through which their tracks run, from curb to curb. There is no doubt that if this act is passed it will mean the saving of thousands of dollars to the taxpayers of Boston and will result in a substantial saving in the usual appropriation for the care of streets.

At a recent meeting of the executive committee of the Lynn Board of Trade, the members of the sub committee appointed to interview President C. A. Coffin of the General Electric company and ascertain if there was any likelihood of the works being removed from Lynn, reported that they had had an interview with Mr. Coffin, and that he assured them that while the matter had been seriously considered, not only of removing the works from Lynn, but also from Schenectady, it was practically settled that this would not be done and that the works would remain about as they are.

A new street railway corporation has been formed in Dedham and articles of association drawn and subscribed to. The capital stock of the company is $75,000 and the new road will be known as the Norfolk Central street railway. The board of directors chosen is as follows: Hon. John R. Bullard, Thomas T. Robinson, Dr. John W. L. Chase, Henry C. Delano, Ferdinand F. Favor, all of Dedham; Francis Doane of Norwood and A. R. Whittier of Boston. The length of the road will be about 10 miles and it will be of standard gauge.

One hundred and ten moulders employed in the Lynn shops of the General Electric company went out on a strike recently for more pay. The superintendent says that the men acted hastily; he has little fear of serious interference with the company's work. It is hinted now that the removal of the company's works from Lynn depends largely upon the ability of the company to secure enough men to fill the places of the strikers. If successful, the works will probably remain in Lynn; if not, steps will be taken to remove the plant elsewhere.

At the annual meeting of the Braintree & Weymouth Electric Street Railway company stockholders in Weymouth, these directors were elected: Charles H. French, president; John Kelly, vice-president; O. A. Chapman, treasurer; J. G. Worster, Joel F. Sheppard, Edward W. Hunt, Josiah Read, E. B. Nevins, R. V. Ranton, I. L. Butterick and D. A. Brooks, clerk. A dividend of 5 per cent. on the road's stock issue was declared, to be computed at the rate of 5 per cent. interest on each share of stock from the time the money was paid in to July 1, 1895; from that date all stock will draw dividends equally. The treasurer's report shows $9,000 net surplus earnings on hand, as a result of the summer's business to September 1st.

A settlement of the locally famous electric light battle between the town of Blackstone, Mass., on the Rhode Island border, and the Electric Light company of Woonsockett in the latter state seems to be near at hand. The trouble is one of several months' standing and the town has been in darkness for two months. It is so dark in Blackstone that special constables are on duty nights and orderly people, it is said, are afraid to go out of doors, after twilight. A petition has been put in circulation for a special town meeting with a view to authorizing the selectmen to contract with the Woonsocket company for two years at 50 cents.

The city of Brockton has passed an ordinance which provides for the placing of all wires within the limits of the city underground.

Important haulage experiments have just been made on the electrically equipped branch of the New York, New Haven & Hartford railroad at Nantasket. It was demonstrated that it was just as easy to handle freight as it has been to carry passengers, and the management of the road is exceedingly gratified over the outcome of the tests. The experiments were made with the motor cars and heavily laden flat cars freighted with blocks of granite. The first test was made with a two-motor car, which was attached to nine cars, the combined weight, including the freights, being 302 tons. A test with a four-motor car followed. The car was weighted with 5,000 pounds of iron for ballast and attached to seven carloads of granite, weighing 243 tons. This load was moved easily. Then the weight was increased to eight cars, and then to nine cars, and 302 tons, which was hauled with ease. The ballast on the motor car was doubled to 10,000 pounds, and 10 carloads of freight, weighing 335 tons, was readily pulled. Twelve carloads, weighing 400 tons, was as easily handled, but with 14 carloads, weighing 470 tons, the train moved slowly. The power shown by the motor car in this last test was equal to that of a 42-ton locomotive. The two motor cars were coupled together and attached, successively, to 18, 21, 25 and 30 cars, carrying respectively 608, 714, 833 and 954 tons, all of which loads were easily handled. Tests were also made with the open motor cars, and a speed test of one of the open cars showed a speed of 72 miles an hour. President Clark of the Consolidated, in comparing steam and electricity for carrying freight, gave it as his opinion that electric motors at frequent intervals could perform the work cheaper and better than it could be done by steam. Outside of the officials of the Consolidated who witnessed the tests were Professor Elihu Thomson, W. H. Knight, W. B. Potter, C. C. Pierce and Gardner M. Wells of the General Electric company.

Charles F. Hopewell, the present superintendent of an electric plant in Fitchburg, Mass., has been appointed superintendent of wires for the city of Cambridge. Mr. Hopewell is a young Cambridge man and a graduate of the Massachusetts Institute of Technology, an institution which has turned out many of the brightest and best equipped electricians in the country. C. S. G.

## Buffalo and Niagara Falls.

BUFFALO, November 2.—The franchise giving the Niagara Falls Power company permission to lay its mains and transact business in this city will come up for further consideration by the aldermen on November 13th, the matter having been postponed until that date.

The Carborundum works at Niagara Falls were started into operation on a recent Saturday. A number of guests were present. President Acheson stated that the Carborundum company was the second industry to start up with the Niagara power and that it had the largest electrical power ever used as one unit and the largest furnace in the world.

There seems to be no longer any question that the city of Niagara Falls will experience a big advance in all business interests in the next six months. The Niagara Falls Power company now has electrical power ready to deliver and choice manufacturing sites ready to be occupied. It was recently announced that the company had about closed contracts for four new manufacturing concerns, which would locate at the Falls at once if guaranteed sewer facilities by the city. It is now settled that at least one of these concerns will be in operation as soon as possible. The contract for the Acetylene Gas company's new plant has been awarded to Lennon & Brass, and work upon the structure has been begun. The factory building will cost $30,000, and is to be completed by January 1st, according to the terms of the contract. The building will be of brick, L shaped and 40 by 89 feet in size. To start with 1,000 horse power will be used, which will be increased after a time. The company expects by the first of the year to turn out, in brick-shaped form, the calcium carbide which, with the addition of water, forms the new illuminating gas. The contract for the electrical machinery will be let in a few days. F. C. P.

## St. Louis, Mo.

ST. LOUIS, November 3.—The northern extension of the Southern Electric Railroad company has been put into operation. It runs north over Seventh street to Howard street and returns south over Sixth street to the old terminus at Market street. A greater part of the new line is over the tracks of other companies—the Cass avenue, Union line and Northern Central. A commission which was appointed for the purpose awarded a semi-annual assessment of $424.68 against the Southern company for the use of the tracks of these companies. The award expressly includes the use of the span wires over a short portion of the line on Sixth street. To this award the Northern Central took exceptions and appealed the matter to the Circuit Court, where the case is now pending. The matter being in court, the Northern Central company claimed that the Southern had no right to use its span wires, and threatened to prevent the stringing of the Southern trolley wire thereon. This threat caused the Southern company to apply to the Circuit Court for an injunction restraining the Northern Central from interfering with the stringing of its trolley wire. The court granted a temporary injunction against the Northern Central. The Southern then put up its trolley wire without further interference and put the extension into operation.

Some three years ago the Lindell Railway company began the construction of long cars composed of two ordinary 16-foot cars consolidated in such a way as to produce two compartments with a vestibule and side doors between the two. The company had a large number of 16-foot motor and trailer cars on hand, and the superintendent, G. W. Baumhoff, desiring to have larger cars to accommodate the increased travel and also to gain the advantage of the weight of the passengers for traction purposes, decided to make the change. The consolidated car was designed by him and is known as the Baumhoff car. The design appeared to be an infringement on letters patent granted to Edwin Chesterman. Chesterman brought suit in the United States Circuit Court against the Lindell Railway company for infringement of his patent. Judge Thayer, however, dismissed the suit, saying that the building of a car after the manner described in the letters patent would naturally suggest itself to anyone who wished to construct a street car in such a manner as to provide a smoking apartment, the fumes from which were to be kept out of another compartment of the car. The patent was declared to be destitute of patentable features.

The Planters' Hotel is now equipped with a complete telephone exchange system, which takes the place of the annunciator. Each room has direct communication by telephone with the central exchange in the office. P. C. Burns of Kokomo, Ind., the inventor of the system, supervised the work. R. J. H.

## Northwestern Notations.

MINNEAPOLIS, November 1.—The Butte, Mont., city council has granted a franchise to the Butte Consolidated Street Railway company to build a line on Montana street to carry passengers, freight and ore. Other improvements are contemplated which will cost about $50,000.

The Sioux City Traction company, the Sioux City Cable company, the Sioux City & Leeds Electric Railway company, the Sioux City Elevated Railway company, and the Sioux City & Suburban Railway company have consolidated their properties, and they will be turned over to a syndicate of New York capitalists. The South Sioux City electric railway will connect with the new system over the new Pacific Short Line bridge.

Receiver H. B. Moore of the Great Western Manufacturing company of Duluth, Minn., has secured possession of the stock of that company, heretofore in the possession of the First National Bank of Chicago, under a bill of sale

given just prior to the appointment of the receiver. He brought suit against the bank in the state court to have the sale set aside on the ground that it was giving preference to the bank as a creditor. The case was transferred to the United States court later. The defendant has now filed a stipulation, withdrawing its answer and consenting to judgment being entered for the plaintiff. Another stipulation admits that the plaintiff is entitled to the property and provides for a dismissal of the case without costs, the plaintiff to pay the defendant $100 costs. The case of H. B. Moore, receiver, against the American Loan & Trust company of Boston is still pending.

The Bigelow Electric Light company of Lincoln, Neb., secured the contract to put in an electric light plant for Vinton, Iowa.

The electric light plant at Grand Rapids, Minn., is having new machinery added.

Arcadia, Wis., will put in electric lights in connection with the lighting plant to be put in by the Arcadia Milling company.

C. G. Nickells, a Wahpeton, N. D., capitalist announces that he has interested other capitalists who will put in an electric car line at Fargo, N. D., and Moorhead, Minn., providing a franchise can be secured in the latter place.

The city council of Rochester, Minn., is considering extending the electric light system.

The Central Wisconsin Electric Railway company has secured a further extension of time in which to complete its electric line at Oshkosh, Wis., and also to Kaukauna. The Central Construction company of Oshkosh was organized with $300,000 capital stock to build the line for the Central Wisconsin, and it is stated that work will now be pushed with vigor.

The project of an electric car line to Lake Minnetonka, from Minneapolis, is revived again, this time in connection with the proposed purchase of Sir Charles Gibson's place "Northome," for a county park.

J. H. Rafferty has secured the signatures of the incorporators of a company which proposes to build an electric line at Waterloo, Iowa, and to build into Cedar Falls.

The city council of Seattle, Wash., has ordered the electric light, telephone and telegraph wires underground.

Property owners on First street in Portland, Ore., have raised a fund of $18,200 to secure an electric car line on that street. The contract for its construction was let to Sidney Smith of Oregon City, at $17,000, and it is to be completed in 75 days.

The General Electric company of Yankton, S. D., has its plant completed and ready for operation. This was one of the enterprises of J. T. M. Pierce, and was, like the others, left in an unfinished state when his schemes collapsed. The English creditors furnished the funds to complete it, realizing that it was the only way they would be likely to get any return from it. The plant is a first-class one throughout, and costs $25,000. It is duplicated throughout, and in case of accident one set of machinery can be substituted for the other almost instantly.

The Citizens' Electric Light & Power company of Menasha, Wis., which some time since secured the franchise for lighting the city, has refused it, owing to the dissatisfaction of the citizens over the matter. New bids are being taken.

March 1st the city of Anoka, Minn., served notice on the electric light company that no more service would be accepted. The lights have burned and there is a bill of $3,000 now due, which the city will in all probability refuse, and it will likely be taken into the courts.

Rush City, Minn., will have its streets lighted by electricity.

Efforts are being made at Montevideo, Minn., to work up a sentiment for electric lights.

The printing telegraph machine of J. E. Woodbridge of Duluth, Minn., has been on exhibition there for several days. It has now been taken east and will be tested in New York and afterward brought to the attention of the public. It is especially designed for long-distance work on quadruplex lines. Tests in Duluth over an artificial line demonstrated that it would print fifty words per minute. It is expected that a much greater speed will be reached.

The board of public works of Tacoma, Wash., will at once add new machinery for the electric light plant to cost about $10,000.

The Munson Electric Conduit company has incorporated at Davenport, Ia., with $10,000,000 capital stock. The company will acquire the ownership of the Munson electrical patents, do a general business under them, construct electrical railways, etc. The incorporators are John H. Munson, James E. Merritt and William F. Roberts.

An effort is being made to secure a franchise for trolley cars at Albert Lea, Minn., to be run in connection with the electric light plant.

The Central Wisconsin Electric Railway company claims to have arranged for a $300,000 loan, which, however, is not accessible until 15 miles of road between Oshkosh and Kaukauna, Wis., are completed and in operation. A further provision is that unless the full line is in running order by January 1, 1896, the loan is annulled. In order to finally obtain this loan an attempt is being made at Oshkosh to form a construction company, which will be composed of firms who will furnish materials, machinery and funds to equip, build and operate the road pending the securing of the loan.

The Twin City Rapid Transit company is using the system of joining rails invented by Albert Hoffman and manufactured by the Falk Manufacturing company of Milwaukee, on the interurban line between Minneapolis and St. Paul. Instead of using plates to join the rails, molds are put on each side of the track and molten iron is poured in. Between the ends of the rails small wedges of steel are inserted, which melt when the iron strikes them and joins the two rails. It is claimed it will do away with the low joints which make rough riding, and will also lessen the wear on rails and on electric machinery. Mr. Hoffman has a large contract with the company, which will take about 1½ years to complete.

Charles Medera, a 17-year-old boy, was killed by grasping an incandescent electric lamp with one hand and a gas pipe with the other in the office of the Fish Brothers' Wagon company of Racine, Wis. The voltage was known to be low, and it is thought strange that the boy should succumb to so light a current.

The street cars of West Superior, Wis., are being vestibuled in compliance with the new state law.

M.

## PERSONAL.

The electrical fraternity in and about Chicago, and especially the many customers and friends of the Central Electric company, will be interested to know of the marriage of Miss Blanche Rosenhaupt, President George A. McKinlock's private secretary, to Frank Martin Pierce on Wednesday, October 30th. Miss Rosenhaupt has been Mr. McKinlock's trusted assistant for many years. In fact, she has been with the Central Electric company almost from the start, and there will be few of the numerous callers at the company's Adams street headquarters that will not remember her courteous attention and assistance whenever an interview with the "powers that be" was desired. Mr. and Mrs. Pierce are now in the East enjoying their honeymoon. Their "at home" cards, however, are out for Friday, November 15th, eight to ten o'clock, at 2974 Vernon avenue. The many friends of the young lady extend hearty congratulations.

## ELECTRIC LIGHTING.

The village of Mt. Sterling, Madison county, Ohio, will receive sealed proposals until noon on Tuesday, November 12, 1895, for furnishing work and material for the construction of an electric light plant.

The Central New York Light & Power company has been incorporated, with directors for the first year as follows: H. Walter Webb and W. H. Gelshennen of New York, William J. Arkell of Canajoharie, A. M. Young of Waterbury, Conn., and J. W. Warner of Oneida. The capital stock of the company is $100,000 and the object is to carry on all kinds of business requiring electrical power. This company is now the owner of the electric light plants of Canajoharie, Gouveneur and Oneida, and has in prospect the acquiring of others.

## ELECTRIC RAILWAYS.

At the last meeting of the Chicago City Council Alderman Cooke introduced and had referred an ordinance authorizing the Chicago Central Electric Railroad company to construct a trolley line commencing at Halsted and Congress streets, west on Congress street to Loomis, thence south to Polk street, along Loomis street over such property as may be acquired by the company, west on Polk street to Sacramento avenue, south to Taylor street, west to Kedzie avenue, thence west over such lands as may be acquired by the company to Central Park avenue, thence west to the city limits; also commencing at the intersection of Taylor street and Central Park avenue south to the city limits.

Articles of incorporation were filed at Albany, N. Y., last week for a railroad company to be known as the Irondequoit & Lake Shore Electric Railway company. The incorporators are: E. O. McNair of Warsaw, A. J. Johnson of Irondequoit, J. C. Tone of Irondequoit, E. S. Ellwanger of Rochester, F. W. Elwood of Rochester, Joseph A. Johnson of Rochester, George Wilson of Rochester, Daniel Platt of Rochester, Horace Pierce of Rochester, George Wilder of Rochester and D. W. McNair of Warsaw. The directors are Messrs. A. J. and J. A. Johnson, Tone, Elwood, Ellwanger, and E. O. and D. W. McNair. The road is to extend from Windsor Beach to Forest Lawn, summer resorts near Rochester, N. Y., and work is to be commenced this winter.

Another example illustrating the confidence of capitalists in electric railroads connecting cities with suburban towns and summer resorts is presented in the case of the Glen Haven railroad, which was sold on mortgage foreclosure held by the Rochester Trust & Safe Deposit company, at Rochester, N. Y., a short time ago. The road was sold to Frank P. Crouch and Chauncey C. Woodworth for $22,022. The new owners will begin work immediately for next season's business. All the old steam locomotives will be sold, it being the purpose of the management to substitute electric power. Of course, this will necessitate the equipment of the road with new cars. The Glen Haven road was built in 1889, and has never been a financial success. It is said that in the five seasons the road has been in operation something like $200,000 has been lost.

The People's Traction company of Philadelphia not long ago accepted the resignations of 15 of the best conductors on its lines, and did so with regret. Following the name of each of the men who resigned the words "Resigned, O. K.," were entered on the company's record book. That meant that any of the 15 who applied for work at any time in the future could get it if there was the slightest chance. The young men were all students in the Jefferson Medical College, and the superintendent of the line says they made the best conductors employed by the company. All told this summer, more than 50 college students were on the payroll of the company. Their earnings averaged about $15 a week, and as they were able to live for about $5 a week, most of them have money enough to pay their expenses this year at college.

The General Electric Railway company introduced its first ordinance in the Chicago City Council last week asking permission to build a crosstown line on Fifty-sixth street from Western avenue to Morgan street, on Morgan street to Fifty-seventh, and on Fifty-seventh from Morgan street to Wabash avenue. A second ordinance will be introduced by the same company for a downtown route between Jackson and Twenty-third streets on Plymouth and Custom House places and Dearborn street. This is the company that proposes to build an under-car system, and its canvassers are now busy on a large number of south side streets. Among the routes proposed is one on South Park avenue to Sixty-third street, connecting with the Calumet Electric Street Railroad company and forming a through electric line to a dozen southern suburbs.

Complaint is made by people living on the line of the Nassau Trolley company in Flatbush on account of the extraordinary noise created by the passing cars. This is exactly the opposite of what was expected and promised when the construction of the road was undertaken. Not only did the company glowingly proclaim its intention of carrying passengers a hitherto unknown distance for the modest fare of 5 cents, but it laid special emphasis on the fact that both jolting and noise would be reduced to a minimum. This was to be accomplished by welding the rails by means of electricity at the joints, thus making practically a continuous rail and avoiding the shocks that occur whenever the point where two rails come together is passed by the car wheels. But the beautifully pictured process did not work, according to the *New York Tribune;* at least that is what people living in Church Lane declare. Instead of continuous rails, the road, they say, appears to consist of a series of depressions and elevations, and the cars go thumping and rattling along in a most distressing fashion. The noise is described as most annoying and even in the remote parts of houses standing well back from the street the passing of a car registers itself painfully. In that part of the city the requirement of a speed of no more than eight miles an hour does not apply, and while the ostensible limit is 10 miles an hour, little heed to the requirement is made.

## TELEPHONE.

The village board of trustees has decided to grant a franchise to W. Stanley Bruen to erect and operate a telephone system in the village of Penn Yan, N. Y. An automatic system will be used. After the system is established it will be extended up each side of the lake, to Keuka on the east and Gibson's on the west. It will also be extended into Ontario county. The installation of this plant, it is hoped, will reduce the charges for telephone service in the town from very high to very reasonable figures.

Articles of incorporation of the Smith-Vassar Telephone company have been filed in the county clerk's office in New York city. The capital stock of the company is $1,000,000, and its object is to manufacture and operate a signal and call system for telephone and telegraph purposes, and to acquire and hold stock in other corporations engaged in a similar line of business. The directors of the company are Frank S. Pusey of Council Bluffs, Iowa; William L. Beardsley, Frederick J. Winston, Joseph F. Barling, Augustus W. Hand, Charles W. Durland and Edward Schmidt of New York.

*Pearson's Weekly* tells the following as a true telephone story: "A large firm in Aberdeen recently engaged as office boy a raw country youth. It was part of his duties to attend to the telephone in his master's absence. When first called upon to answer the bell, in reply to the usual query, 'Are you there?' he nodded assent. Again the question came, and still again, and each time the boy gave an answering nod. When the question came for the fourth time, however, the boy, losing his temper, roared through the telephone: 'Man, a' ye blin'? I've been noddin' me heid aff for t' last hauf oor.'"

## TELEGRAPH.

The London correspondent of the *Sun* writes: "I have seen to-day an amusing official note from the censor at Constantinople. It is addressed to a well-known correspondent and says that in order to make a message more accurate and explicit he added 10 words to the latter's telegram the previous night, and asks the correspondent to send along $2 to pay for the added words. It is useless to protest in Turkey, so the correspondent sent the money, but at the same time respectfully suggested that if the censor would write his messages entirely and merely forward him the weekly cable bill it would save him much unnecessary trouble. The

censor is taking time to consider whether this offer is serious or sarcastic."

The *London Times* says that Alexander Siemens, with a representative of Clark, Forde & Taylor, consulting engineers to the Amazon Telegraph company, is now engaged in surveying the route for the new cable about to be laid up the Amazon from Pará to Manaos under exclusive concessions from the government of the Brazilian Republic. The entire length is 1,365 nautical miles, and there will be in all 16 stations on the line. The Faraday will probably leave England next month with the cable, more than half of which is already manufactured. This long sub-fluvial line will for the first time bring these regions, so increasingly productive of India rubber, coffee and sugar, into direct telegraphic communication with Europe. All past attempts on the part of the Brazilian government to establish aerial lines through these districts have failed, owing to the rapidity and density of the forest growths. Mr. Reidy, representative of the Amazon Telegraph company, joined the expedition at Pará. The great importance of the Amazon as a trade route may be gathered from the fact that the Faraday, a steamer of 5,000 tons burden, will proceed all the way up to Manaos, a distance of 1,100 miles from the mouth of the river.

## MISCELLANEOUS.

A dispatch from Akron, O., states that the works of the Falls Rivet & Machine company at Cuyahoga Falls were partially destroyed by fire on October 26th. The loss is $35,000, fully insured. Six hundred men are thrown out of employment temporarily.

George Hoyt of Cleveland, O., is authority for the statement that apparently one of the last important acts of the late Franklin Leonard Pope's life was the preparation of an elaborate opinion of the patent claims of the Ford-Washburn storage battery, to the effect that they do not infringe, in the slightest degree, any other storage battery patents. Mr. Pope's paper was dated October 5th and was accompanied by an autographic personal letter.

There will soon be located in Chicago a technical school, entitled the Correspondence Technical University. The Institute for Home Study of Electricity of Cleveland will remove here, and courses in eight additional branches of engineering will be established under the above name. F. D. Leslie and associates of Cleveland, owners of the Institute, will be joined in the new enterprise by A. M. Leslie of the *Farm Implement News* and others of Chicago.

An English contemporary relates that the searchlight has recently been put to a rather suggestive use at Stalybridge, at Messrs. Gartside's works, where there is a strike, in connection with which rioting has taken place. The light has been used with the idea of preventing the strikers from maliciously setting fire to the temporary sheds erected for the protection of the men at present employed. It is now being used nightly, in conjunction with the police force established at the works, to search the surrounding country and to illuminate the various parts where pickets are placed. It is said that the arrangement enables the services of a number of policemen to be dispensed with.

The results of some recent experiments of Dr. Haldane have been made public. They refer to the presence of black damp; he finds that when the percentage of oxygen has fallen to 17.64 a candle is extinguished, at 3 38 per cent. of carbonic acid gas and 15.3 per cent. of oxygen his respiration began to deepen, and at 7.32 and 9.6 per cent. respectively there was violent panting; at 7 per cent. of oxygen consciousness would probably have been lost. He thus shows that there is a wide margin between the point of the extinguishing of a lamp and the point of danger to life; a miner provided with an electric lamp could, therefore, penetrate with impunity or escape through atmosphere containing at least three times as much black damp as would extinguish a lamp and the difficulty of respiration would give ample warning if the electric lamp did not.

The echo organ at Westminster Abbey, which Mr. Clarke of yachting fame some time ago undertook to provide, has now been fixed in the triforium above Tennyson's monument, says the London correspondent of the *Sun*. The new instrument is electrically connected with the main organ. A new keyboard has been added to the already complicated organ, making five manuals, and there are electrical contrivances in great variety, by means of which the couplings and stops are put into and out of action. The effect of touching the keys on the new manual is instantaneous, and the echo organ is as sensitive in responding as is the main instrument. The effect is found to be charming, but the instrument will not be brought into general use till Dr. Bridge, the organist, returns from his holiday.

## TRADE NEWS.

R. W. Gordon, of the Gordon-Burnham Battery company of New York, has left for an extended trip through the central and western states. He expects to return about December 1st.

Osgood & Barker, the well-known manufacturers of paper mill machinery of Bellows Falls, Vt., have begun the manufacture of dynamos and motors, and will give special attention to the building of motors for boats and carriages; they will also do railroad and general electrical repairs. Among the orders now on hand is one for a two-horse power motor for use in a launch now run by steam. The firm is also building a 200-light dynamo for a neighboring manufacturer.

The Electric Appliance company is making some radical changes in the arrangement of its building at 242 Madison street, Chicago. The general office now occupies the second floor, leaving the entire first floor for the store and shipping room. The Appliance company now occupies the entire building at No. 242 Madison street, four floors, with a floor space of about 20,000 square feet, and claims to have the largest building in the West which is entirely and exclusively devoted to electrical supplies. The officers of the company invite their friends to call and inspect the new arrangement of their building, of which they are justly proud.

Eugene McOuat has succeeded E. E. Cary as superintendent of the factory of the Beacon Lamp company of Boston. Mr. McOuat entered the electrical field in 1880 with the old United States company of New York, and was connected with Edward Weston of Newark in 1888, after which he was connected with the Sawyer-Man company until 1890, since which time he has been with the Beacon company. During all this time Mr. McOuat has been actively engaged in the manufacture of incandescent lamps He has now assumed charge of the factory. Manager Hambay reports that business has never been better than at present.

Passengers east from Chicago should bear in mind the through fast express over the Nickel Plate road from Chicago daily at 1:30 P. M. runs entire train through to New York City with elegant sleeping cars to New York and Boston, arrives at Cleveland at 11:30 P. M. This train is supplied with colored porters in uniform to attend to the wants of both first and second-class passengers. The night express leaves daily at 9:20 P. M. with through sleeping cars to New York and Boston. The loest rates are given on all trains to all points east. For additional information as to time-tables, tickets, etc., call on or address J. Y. Calahan, general agent, 111 Adams street, Chicago, Ill.

The *Cleveland Plain Dealer* of October 30th is authority for the statement that two gentlemen from Paris, France, F. de La Briere and C. La Blanc, have closed a contract with the Walker Manufacturing company of that city whereby the electrical machinery made by the Walker company is to be extensively introduced into Europe. Messrs. de La Briere and La Blanc are said to represent a group of French capitalists who control millions of dollars for the purpose of securing the European control of various American electrical appliances. Mr. La Blanc is reported to have said: "We have made an agreement whereby we secure the European agency of the Walker Manufacturing company. The syndicate which we represent has unlimited capital. To understand our purpose you must understand that electricity has not been generally introduced in Europe as a motive power on street surface railways. There the horse yet is king; in fact the street railway service in Europe is in about the same backward condition it was in this country five years ago. Immense fortunes have been made in this country, as everyone knows, by buying up old horse systems and rehabilitating them and transforming them into electric car lines. That is just what we intend to do in Europe. We have already secured eleven new concessions of franchises, and as our syndicate contains some of the most responsible institutions in France we anticipate little trouble in securing all of the privileges we want. In Europe it is not necessary to pay city councilmen in order to secure franchises. People there are very progressive and are ready to invest in any scheme that seems to be sound. In addition the syndicate we represent will sell the Walker appliances to others wanting them. A feature of this deal is the fact that we can buy American electrical machinery, pay duties on it at the rate of 45 cents per 100 kilos and sell it cheaper than the European article, and the American article is by far the superior of the two."

## BUSINESS.

The Siemens & Halske Electric company of Chicago is issuing a series of attractive catalogues showing various types of its extensive line of electrical manufactures. "Electric Motors," "Band Arc Lamps" and "Electric Rock Drills" are now out and give carefully prepared information on the subjects indicated. The extent and thoroughness of the work of the Siemens & Halske company are shown in these valuable pamphlets.

Charles Wirt has removed to a more central location at 1026 Filbert street, Philadelphia, where he hopes his friends will have less trouble to find him. Mr. Wirt reports that his dynamo brush is better than ever before and that the public is rapidly finding it out.

The Nickel Plate road now offers greater facilities to the traveling public than ever. The improved service in all its departments, including powerful locomotives, promptness as to time; comfortable coaches, nicely decorated, richly upholstered and easy riding; dining cars in which the welfare of the inner man is carefully looked after and satisfied; Wagner palace buffet sleeping cars and substantial stations. These added to the fact of its being the shortest line between Chicago and Buffalo via Fort Wayne, Fostoria, Cleveland and Erie, with through sleeping cars from Chicago to New York and Boston via the West Shore and Fitchburg railroads, all combine to make the popular low-rate line between Chicago and any point East and South. Further information as to rates, time of trains, etc., can be procured from J. Y. Calahan, general agent, 111 Adams street, Chicago, Ill. Depot, Twelfth and Clark streets.

The Newburgh Ice Machine & Engine company has purchased the valuable plant formerly operated by the Whitehill Engine & Pictet Ice Machine company. The officers of the company are as follows: Edgar Penney president and manager, Newburgh, N. Y.; Frank Adams Acer, vice-president, 97 Nassau street, New York; Robert Whitehill, secretary and treasurer, Newburgh, N. Y.; George B. Salisbury, auditor, 11 Wall street, New York. These gentlemen, together with Col. Wm. D. Dickey of Newburgh, N. Y., constitute the board of directors. The capital stock is $300,000, fully paid. The new company has every facility required for the production of high grade machinery at competing prices, and solicits opportunity to submit proposals for furnishing ice-making and refrigerating plants of any capacity, using either ammonia or the Pictet system, and Corliss steam engines and complete steam power plants with steam boilers and appurtenances, general machinery, iron and brass castings, pattern work, etc.

The Julius Andrae & Sons company of Milwaukee is as busy as ever. It has issued a complete telephone catalogue and reports a good business in this department. It is rushed with electric lighting work, also, and has just installed an electric light plant of 300 lights in the new bicycle factory of the Julius Andrae & Sons company; also wired for electric lights the following named factories and buildings: Bolte Bicycle Manufacturing company, Mieselbach Cycle company, Wisconsin Wire & Iron Works, the Bradley flats and both yards of the Milwaukee Dry Dock company. During the Milwaukee semi-centennial celebration the value of the electric light for artistic decoration was again demonstrated. One of the largest pieces in this line, a sign 80 feet long, having letters three feet high and composed entirely of 16 candle power lamps, containing a total of 445 lamps, was made for the F. F. Adams Tobacco company. Besides this the company decorated many buildings and signs with electric lights, and on a similar occasion in future it can guarantee that twice the amount of such work will be done, since the public has now seen the practical value of such work.

The Eddy Electric company of Windsor, Conn., reports that it is doing a larger business at present than at any previous period since the organization of the company and a full force is employed to turn out the orders. Among the recent installations of this company are the following: 1,000 light multipolar generator, Pope Manufacturing company, Hartford; 60 kilowatt multipolar generator, Great Kanawaha Colliery company, Mt. Carbon, W. Va.; two 500 light multipolar generators, Jas. Lee's Sons & Co., Bridgeport, Pa.; two 50 kilowatt direct connected generators, J. B. Van Sciver & Co., Camden, N. J.; 65 kilowatt direct connected, J. N. Adam & Co., Buffalo; 40 kilowatt lighting generator, Augustus Noll, New York; 30 kilowatt direct connected generator, O. Wiederhold, Newark, N. J.; 11 kilowatt lightning generator, Boyden Lumber company, Neelyville, Mo.; 25 kilowatt direct connected generator, Bethlehem Silk company, Bethlehem, Pa.; 40 kilowatt generator, Henry R. Worthington, Elizabethport, N. J.; two 60 kilowatt and one 40 kilowattt generators and one 50 horse power and two 10 horse power motors, Wm. Campbell & Co., New York; 40 kilowatt multipolar lighting generator, Eagle Bicycle Manufacturing company, Torrington; 20 kilowatt lighting generator, Excelsior Needle company, Torrington, Conn.; two 50 kilowatt directly connected generators, National Theater, Philadelphia.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued October 29, 1895.*

548,669. Insulator Pin. Charles W. Stephen, Camden, N. J. Application filed February 9, 1895.

This device comprises a tapering sleeve of insulating material, having an external thread to receive the insulator cap, and provided with a longitudinal opening, a bolt passing through the sleeve and cross-bar, and having a head resting upon the upper end of the sleeve, and a nut for tightening the bolt and sleeve in place, the opening in the sleeve being slightly larger than the bolt.

548,682. Electric Arc Lamp. Malone Wheless, Washington, D. C. Application filed May 2, 1895.

The positive carbon holder is provided with slots. There are also binding cams and plates for holding the cams to the carbon holder and the clamp for limiting the upward movement of the plates.

548,683. Electric Arc Lamp. Malone Wheless, Washington, D. C. Application filed June 8, 1895.

The feature of the invention is the combination of the yoke, the cap and the counter-weight, the latter being pivoted both to the cap and the yoke.

548,684. Dynamo-electric Machine. Norman Whichello, Chicago, Ill. Application filed July 18, 1895.

In this machine the combination is claimed with a flat or curved core, having its edges V-shaped, of metallic and insulating ribbons interwrapped about the edges of such core and conforming to the shape thereof.

548,700. Electrical Recording Apparatus. Albert C. Crehore, Hanover, N. H. Application filed April 8, 1895.

Included in this arrangement are a polarizer, an analyzer, a medium placed between them and adapted to rotate the plane of polarization under the influence of a magnetic field, an electric circuit for producing the magnetic field, a circuit-controlling device for producing sudden interruptions at certain intervals, thereby interrupting the beam of light, and a photographic recorder in the path of the beam of light emerging from the analyzer, the recorder and beam of light moving relatively to one another to produce a clearly defined image of the interruptions in the beam.

548,701. Indicator for Electric Currents. Albert C. Crehore, Hanover, N. H. Application filed May 25, 1895.

This method of recording the variations in an electric current consists in polarizing a beam of light, resolving it into the colors of the spectrum, producing a dark band in the spectrum, rotating the plane of polarization by the action of the current, and photographing successively the variations in position of the band, thereby producing a sinuous curve showing the variations in the strength of the current.

548,704. Trolley Wheel. Ferdinand J. Feldt, Peoria, Ill. Application filed April 20, 1895.

The body has the oil recess formed in each side thereof, the hub has the oil channel passing along its bore and communicating with the oil receptacles, a wick lying in the channel, and the plates or caps for closing the oil receptacles.

548,709. Polyphase Alternating Current Motor. Fred S. Hunting, Fort Wayne, Ind. Application filed March 14, 1893.

An alternating current induction motor is shown, having a primary winding and a polyphase secondary winding, the coils for each branch of the latter being sectional and distributed on the core, so that the secondary electromotive forces in the several sections of a branch will be in the same phase.

548,729. Telautograph. George S. Tiffany, Highland Park, Ill. Application filed March 16, 1894.

The reversal is effected by means of currents of opposite polarity in reversing circuits, and in which the lifting or lowering of the receiving pen is effected by changes in the strength of the reversing current, a pen lifter magnet composed of two coils differently constructed, so that they shall not reach the neutral point simultaneously upon reversal of the current.

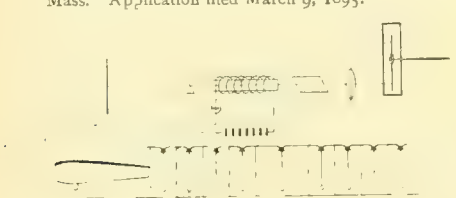
548,730. Dry Battery. John T. Todd, Tuscola, Ill. Application filed February 6, 1895.

There are a containing vessel, a zinc plate serving as the positive electrode and resting against the inner walls of the retaining vessel, a cup or wall provided at the bottom of the vessel to form a receptacle, a hollow carbon electrode communicating with the receptacle and extending from the same to the top of the vessel, solid active material packed within the vessel above the receptacle and surrounding the carbon electrode, the active material being in communication with the receptacle, sealing material adapted to seal the top of the vessel, and a removable stopper adapted to be sealed in the end of the hollow electrode, whereby moistening material may be introduced into the cell through the hollow electrode.

548,748. Microphone. Lars M. Ericsson, Stockholm, Sweden. Application filed July 6, 1895.

There is a supplemental protecting diaphragm between the vibrating diaphragm and the mouthpiece, consisting of silk impregnated with lacquer or like substance.

548,755. Electric Meter. Ralph O. Hood, Danvers, Mass. Application filed March 9, 1895.



NO. 548,755.

The motor has its fixed coils in series with the main circuit, and its movable coils in a shunt circuit to the main circuit. There is a reversing switch for the movable coils, and a device actuated by the motor for intermittingly operating the switch at predetermined times is provided.

548,777. Electrode for Applying Electric Currents. Edwin F. Davis, West Caton, N. Y. Application filed June 10, 1895.

The invention has a conducting portion, a lining therefor of absorbent material, and an insulating covering around the edges of the conducting portion.

548,739. Distribution System for Alternating Currents. Alva L. Searles, Brooklyn, N. Y. Application filed April 18, 1895.

A local distributing system for alternating currents is described, comprising a plurality of transformers, one of which is normally in circuit, a solenoid controlled by energy flowing through the latter, a snap-switch actuated by the solenoid core, two electro-magnetic devices alternately actuated by the snap switch for cutting in or out of circuit an auxiliary transformer when current exceeds or falls below a determinate strength.

548,819. Electric Switch. Hiram Ross, Providence, R. I. Application filed July 17, 1895.

A switch lever, consisting of two current conducting V-shaped pivoted arm members located in different planes, a tie composed wholly of non-conducting material for each arm member detachably secured to the outer ends thereof, and a handle composed of non-conducting material rigidly uniting both of the ties, and through which handle the arm members are operated simultaneously.

548,829. Device for Regulating Current Admitted to Electric Motors. Frank E. Herdman, Winnetka, Ill. Application filed March 22, 1895.

The combination is claimed with a translating device, electric connections from a source of current supply to the translating device, a device for admitting the current to the translating device, mechanism adapted to control the operation of the current admitting device, the controling device being so adjusted that when the translating device receives a predetermined increment of current the current admitting device is held from further acting.

548,830. Automatically Controlling Electric Motors. Frank E. Herdman, Winnetka, Ill. Application filed June 29, 1895.

An electric motor and a source of current supply, an electric circuit from the source of current supply to the field of the motor, a resistance device in the circuit, a circuit to the field independent of the resistance device, a switch device controlled by the motor in the last mentioned circuit.

548,867. Rheostat Element. Harry P. Davis, Pittsburg, Pa. Application filed February 28, 1894.

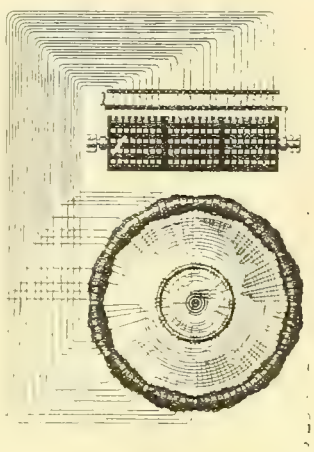
A resistance is composed of a support, and disks strung thereon, some of the disks being provided with knobs for providing restricted contact.

548,897. Telephone Switch. John E. Thomas, Cleveland, O. Application filed April 17, 1895.

There are a rotary reciprocating shaft hooked at one end and provided with a disk at the other, means for imparting the double motion thereto, and a receiver adapted to hang on the hooked end of the shaft.

548,899. Adjustable Incandescent Lamp Holder. Edward Wade, Lawrence, Mass. Application filed April 1, 1895.

Claim 1 reads as follows: An electric lamp holder, comprising the two pivotally connected plates, one having a segmental slot and the other a clamping screw passing through the slot, the frictional washers on said screw bearing against the plate, the rod secured to the plate, the socketed bracket in which said rod is fitted to turn, and the bent arm secured to the plate and provided with an insulating tip.



NO. 548,709.

548,904. Automatic Time Cut-out. Francis B. Badt, Chicago, Ill. Application filed September 24, 1894.

As shown in the cut, there is the combination of an electric circuit containing a source of electrical energy and one or more translating devices, and a cut-out associated with the circuit and adapted to be operated by the heat effect of the current, so as to break the circuit after the current has been flowing for a predetermined length of time, and a compensating device associated with the cut-out to obviate the effect of changes in the temperature of the surrounding atmosphere.

548,924. Electric Train Signal. Myron W. Parrish, Detroit, Mich. Application filed December 24, 1894.

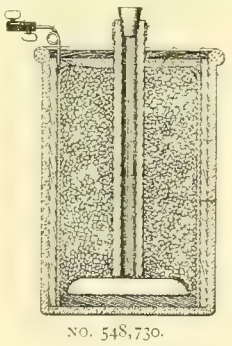
An electric signaling apparatus, comprising a circuit having separated contiguous circuit terminals projecting vertically upward from a horizontal base, a signal in the circuit, a closed circuit having signaling circuit-breakers therein at locations from which the signal is to be sent, a source of electric energy, and a fulcrumed overbalancing armature lever adapted to operate to intermittingly contact with said circuit terminals by an undue diminution of the electric energy, and to make positive contact by operating a circuit-breaker to break the closed circuit.

548,930. Turbine Electric Generator. Charles E. Sargent, Chicago, Ill. Application filed September 19, 1894.

An armature is provided with a series of vanes and suitable ports and supply pipes for delivering a gas at great velocity against the vanes, and for receiving the discharge therefrom.

548,949. Safety and Limit Switch for Electric Motors. George F. Card, Mansfield, O. Application filed August 21, 1895.

The first claim reads: The combination with an electric motor of a cut-out switch of an electro-magnet, having its core projecting at both ends, and forming two poles adapted to cooperate with two independently mounted armatures and release the cut-out switch when abnormally increased or abnormally decreased current energizes the magnet.



NO. 548,730.

548,952. Electric Brake. Frank E. Case, Schenectady, N. Y. Application filed June 29, 1894.

The system for controlling the current flow in the circuit of an electric braking apparatus supplied from a series motor or motors operated as a generating source by the momentum of a moving vehicle or load, consists of means for controlling the excitation of the motor or motors, and thus regulating the amount of current supplied to the circuit.

548,968. Automatic Circuit Breaker Alarm. John H. Devine, Johnstown, Pa. Application filed November 13, 1894.

In an automatic circuit breaker alarm there is the combination of an insulator base block, a bracket plate secured to the under side of the base block and offstanding therefrom, reversely bowed semi-elliptical spring-contact plates fastened at one end to the opposite ends of the insulator base block, and having their free ends overlapping and normally sprung apart, and an insulator strike block fastened on the free end of the uppermost of the overlapping contact plates, and adapted to be engaged by the falling switch arm or lever of an automatic circuit breaker.

548,969. Telegraph Instrument. Orville A. Dickinson, Arverne, N. Y. Application filed July 13, 1895.

The arrangement consists of trunnion points, adjustable nut and lock-nuts, with lever and trunnion posts.

548,976. Closed Conduit Electric Railway. Michael F. Flynn, Stamford, Conn. Application filed November 27, 1894.

The closed conduit, the line wires therein and the switches to engage the wires, the striking cams on the conduit to operate the switches, the cams having opposite arms, one of which is yielding.

548,997. Electric Motor Car Trolley. James M. Kennedy, Hollidaysburg, Pa. Application filed May 31, 1895.

A reversible overhead trolley and means for shifting the same, and a light giving appliance carried by the trolley, adapted to throw the light upon the trolley are provided.

549,023. Secondary Battery Plate and Method of Preparing It. John J. Rooney, Brooklyn, N. Y. Application filed April 1, 1895.

A grid of press-board paper with the sizing removed and rows of perforations therein, active material or material to become active filling the perforations, and conducting strips, each being in contact with the active material in one row of perforations.

549,038. Electric Programme Clock. Leon H. Watters, Media, Pa. Application filed November 30, 1891.

A ring of conducting material has radial means for securing it to the minute post of the clock and radial perforations therein, a pin projecting from one of the perforations, an electric circuit with an alarm therein, a plate of insulating material attached to the clock dial, a spring-controlled lever in the plate having an end normally in the path of the pin.

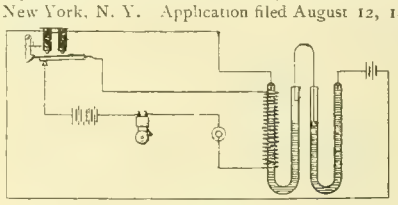
549,053. Telegraph Pole. Albert A. Blow, Denver, Colo. Application filed January 26, 1895.

A collar is secured to the pole and provided with a vertically recessed lug, an arm secured in the lug and bent to extend horizontally therefrom, and insulators are secured to the horizontal portion of the arm.

549,058. Photographic Retoucher. John N. Choate, Carlisle, Pa. Application filed November 7, 1894.

This instrument consists of a rigid framework adapted to be held in the operator's hand, and is provided with electro-magnets and binding posts for the circuit wires, a weighted spring armature which vibrates free or without contact with the pencil, or adjacent portion of the framework, and a retouching pencil which is inflexibly and immovably attached to the framework, and thus makes every movement of the latter, as specified.

549,061. Indirect Control of Motors. Ganó S. Dunn New York, N. Y. Application filed August 12, 1895.



NO. 548,904.

The method consists in connecting the armature and the field coils independently of each other, and supplying the armature with a constant current and regulating the strength of the field.

549,074. Electric Arc Lamp. Regina Niewerth and Hermann Niewerth, Berlin, Germany. Application filed April 25, 1895.

An electric arc lamp, consisting of a stationary carbon, a movable carbon, a holder for supporting the movable carbon, a regulating mechanism, from the lower end of which the carbon holder is suspended, a pawl and ratchet mechanism between the carbon holder and the lowermost member of the regulating mechanism, an escapement at the upper end of the regulating mechanism, a fulcrumed lever connected with the regulating mechanism, a core connected to the opposite end of the fulcrumed lever, and a solenoid surrounding the core.

549,075. Electric Arc Lamp. Regina Niewerth and Hermann Niewerth, Berlin, Germany. Application filed April 30, 1895.

There are a stationary lower carbon, an upper movable carbon, fulcrumed main lever, a solenoid above one end of the lever, a soft iron core located in the solenoid and connected with the main lever, a drum applied to the opposite end of the main-lever, a regulating-mechanism for the drum, a band or chain wound around the drum, and passed through the holder of the upper carbon, and a fulcrumed auxiliary lever connected with the band or chain and with the main lever.

549,079. Secondary Battery Grid and Plate and Method of Preparing Grids. John J. Rooney, Brooklyn, N. Y. Application filed July 22, 1895.

A composite secondary battery plate consisting of a grid of non-conducting material vertical rows of perforations therein, the material in which are alternate rows, having extensions to form foot-rests, absorptive material filling the said perforations, alternate positive and negative conductors each in contact with the absorptive material in one row of perforations, substantially as described.

549,083. Electric Arc Lamp. Malone Wheless, Washington, D. C. Application filed March 6, 1895.

The vertically movable controlling rod, a support therefor and means for limiting the movement of the rod in each direction, in combination with the movable carbon-holder and a pivoted or hinged carbon gripping dog carried by the carbon-holder and connected to the controlling rod.

549,091. Trolley for Electric Railways. Jacob Hess, Scranton, Pa. Application filed May 13, 1895.

In a trolley of the kind described there is the combination with the main trolley wheel of a pair of disks rotatable on axes parallel to the plane of rotation of the main trolley wheel, and closing together above and in the center plane of the main trolley wheel, the disks adapted to be held in the closed position by guides running concurrently with the trolley wire at switches, but adapted to be pressed apart by the wedge-shaped edges of the supports of the trolley wire, and also to be fully opened and released from the trolley wire by means of the L-shaped levers and the arms.

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## Chase Electric Cyclorama.

By an ingenious combination of arc lamps, fed from rubbing contacts on a circular track suspended from the ceiling of an exhibition room, and an arrangement of especially devised projecting lenses and a continuous photographic film, with the necessary mechanism for blending and adjusting the projected sections of the picture in one complete cycloramic view, Charles A. Chase, a Chicago inventor, has devised the interesting apparatus shown by the accompanying illustrations, known as an electric cyclorama.

Mr. Chase has worked for a number of years to bring his instrument to perfection. Cycloramic pictures have hitherto been painted at great expense, and have represented the artist's conception of the scene depicted. By Mr. Chase's invention electricity and the latest developments of photography are combined to present scenes and objects with strict fidelity to nature, including outline and coloring, introducing moving objects and perhaps, ultimately, sounds also. Complete, unbroken horizon scenes are reflected upon canvas, the floor upon which the spectators stand seeming to be a portion of the country viewed, as though one stood on the Wooded Island, for instance, and, turning, surveyed the magnificent roundabout panorama of the World's Fair. By quick manipulation the operator in the overhead instrument can produce other cycloramic scenes in rapid succession. Stress is laid on the fact that a number of the cycloramic pictures can be produced at one entertainment, and also that the views are strictly true to natural scenes at home and abroad. Mr. Chase has in his possession original negatives of foreign and American views and several valuable ones of the World's Columbian Exposition, one of which is an unbroken view of the Court of Honor, taking in the entire horizon, with the lawn at the northwestern corner of the agricultural building as a central point. He also has an unbroken cycloramic view taken from one of the bridges leading to the Wooded Island, and the illusion is realistic. The foreign views are very interesting. Mr. Chase's representatives were abroad last spring and summer photographing scenes and incidents in London, Paris and the vicinity of Monte Carlo with a special camera, and the views obtained are beautiful and a real novelty in photography. These views will be reproduced, greatly enlarged, in a cyclorama building 100 feet in diameter.

FIG. 1. CHASE ELECTRIC CYCLORAMA.—VIEW OF INSTRUMENT, SHOWING LENSES, ARC LAMPS AND CARRIERS.

The general view, Fig. 4, shows the manner of presenting the views. The ordinary cyclorama buildings can easily be remodeled to suit the instrument, which is suspended from the ceiling as shown in the sectional drawing, Fig. 2, by a two-inch gas-pipe and fastened rigidly with wire cables. The floor space is all open, and the perspective is such that it and the audience appear as part of the scene. The illusion is perfect, as the instrument which produces it is suspended from above and cannot be seen without looking up.

A view of the first instrument is given in Fig. 1, while the completed apparatus, as it will appear in operation, is shown in Fig. 3. Fig. 2 is a vertical sectional drawing of the cyclorama building, with the instrument in position. In this drawing *A* is the instrument, *B* the lenses, *E* the gas-pipe support, *F* the wire cable stays, and *G* indicates the height of the picture. By comparing these illustrations with the imagined interior of an electric cyclorama building shown, in Fig. 4, a good idea of the plan and operation of the device may be obtained.

The instrument is eight feet in diameter and 10 feet high, weighing 800 pounds. The operator stands on a platform in the center, as shown in Figs. 1 and 3. Running on a circular track are eight carriers, each supporting an upper and lower projecting lens. Behind each lens is an arc lamp and a reflector, so that a powerful light is secured for projecting the pictures. Colt lamps are used, and the greatest intensity of the light from each is estimated at 5,000 candle power. The current is conducted in insulated wires down through the center gas pipe *E*, Fig. 2, through a switchboard with rheostats and fed into a circular copper track embedded in the runway beneath the carriers. Carbon brushes make contact on these conductors, and from them the current is led to the lamp carbons. The switchboard is on the central support, convenient to the operator's hand, and from it, by rheostats, the light can be controlled and regulated as desired. Preferably, low-tension lamps are used.

The optical and mechanical details have been carefully worked out. The projecting lenses are wide angle and are made of the best Jena glass, according to the Zeiss formula. They will be provided with special iris diaphragms for dissolving effects. Thus while one picture is being shown current can be turned through the other set of lamps for a few minutes until the illumination is perfect, before the picture is changed. The eight carriers can be accurately adjusted in any position around the circumference of the instrument by means of hand-wheels and set-screws. The photographic films, from which transparencies are made producing a picture 300 feet in circumference and 35 feet high, are seven feet long and eight inches wide.

Naturally, the rays of light from the different lenses cross each other, overlapping the picture. By careful manipulation, however, the sections are exactly registered, and the light at the overlapping portions is cut down one-half by special apparatus attached to the lenses. This adjustment is only made once in a given-sized building; thereafter all pictures come to exact position with precision by the turn of a hand-wheel.

In the lower part of the instrument, as shown in Fig. 1, is a space for operating special devices for mechanical moving effects which are introduced into the scenes, such as moving clouds, moonlight, searchlights, boats, naval battles, etc. This can be done by the old stereopticon methods scientifically improved, or by use of the kinetoscope or the eidoloscope.

In August of last year Mr. Chase, at the Chicago Fire Cyclorama building, reproduced and enlarged a continuous photograph four inches wide and 32 inches long to a cycloramic picture 160 feet in circumference and 15 feet high. Although made with the crude appliances that were then at hand, the test surprised and delighted those who witnessed it.

## Electric Funeral Trains.

The economy and advantages of electric transportation to cemeteries for funerals are becoming widely recognized. In Chicago the Calumet Electric Railway company is taking the lead in this departure, and it now has an especial funeral car in process of construction which will be ready to run to Oakwoods in about a month. Funeral corteges by rail will not be entirely new on this line. Funeral trains with ordinary cars have been used about every other day the last summer. The motor car took the place of the hearse. The backs were removed from the three front seats, which became the rests for the coffin. On either side sat the officiating clergyman and the pallbearers. Behind these the mourners filled the car. Other friends found accommodation in trailers. Two trains were in use, one of three cars and one of four. One or the other was in use frequently. Every week, and sometimes three or four times a week, funeral processions came from West Pullman, Kensington or Gardner's Park by street railroad, thereby avoiding the long, dusty drive in carriages. A great many of these were Masonic funerals and those conducted by other orders.

The custom of using trolley cars as a means of funeral transportation did not abate with the coming of autumn, and closed cars were substituted for the open ones. Into

these the casket was lifted over the rear dasher and laid crosswise of the car, the head and foot resting on the seats. This car was also reserved for the family and friends of the deceased.

The body of the new car will be black. Even the trolley pole will be wound with crape. When the deceased is a child this will be white and the sides of the car will be festooned with white. If an older person is to be buried, the funeral hangings will be black.

Inside the car, just back of the motorman, a bier will occupy one side. Opposite this are to be seats for the minister and pall-bearers. The mourners will sit along the sides of the car. Friends will sit in the cars, also black, that will take the place of trailers. The car in which the body is carried will have a suitable entrance arranged to admit the coffin to the forward end. The cost of this car will be about $2,000.

Funeral parties may charter a train with almost any number of cars and start from any point on the line. A special motorman and conductor will be uniformed in black. At Oakwoods, which is the point to be reached by funeral trains on this line, the cortege will be switched in upon a side-track and the coffin borne to the grave.

If the funeral car is a success, others will be built, both for the Calumet Electric Railway company and other Chicago street railroads. Arrangements will be made to switch funeral trains to the tracks of the North Chicago system and to the West Side tracks, enabling such trains to reach Calvary and Graceland, and by way of Cicero & Proviso lines to Waldheim they will reach Forest Home and Concordia cemeteries.

## Electro-thermal Chemistry of Calcium Carbide.

By C. Knox Harding.

Calcium carbide is the modern name of a substance which has recently gained prominence on the stage of modern chemistry. No chemical compound of recent years has excited such general scientific or popular interest, and the wonders of aniline and the rainbow tinted compounds from coal-tar are by comparison cast deeply in the shadow.

The term "calcium carbide" is not found in dictionaries or encyclopedias, nor is it even found in chemical dictionaries, but the compound will be found described under the name calcium acetylene, the propriety of which is apparent when we consider acetylene as the two carbon atoms united to form the carbon molecule which combines with hydrogen to form the gas acetylene, $H_2C_2$, which is considered organic, or might otherwise be called hydrogen carbide. But this is the neutral ground on which organic and inorganic chemistry meet, discovered 50 years ago by the eminent chemist, Wohler, who gave the world aluminum. It is now being re-explored and investigated by the light of the seven times blasting heat of the modern electric furnace, and will prove the surest isthmus which unites the inorganic and the organic world, so we call the compound of one part of calcium (Ca), the metallic base of lime, and two parts of carbon ($C_2$), the inorganic name calcium carbide ($CaC_2$), and the compound with the two parts of hydrogen ($H_2$ and $C_2$), ($C_2H_2$) acetylene, or ethine, though hardly a step advanced in the realm of organized matter.

The inter-convertability between the carbides and acetylene is thus the important feature. $CaC_2 + H_2O = CaO + C_2H_2$; that is, 64 pounds of carbide will decompose 18 pounds of water and form 56 pounds of lime and 26 pounds of acetylene, and again $C_2H_2 + Cu_2Cl_2 = Cu_2C_2 + HCl$ and Aq, or if the gas acetylene is passed into a solution of cuprous chloride with say ammonia to take up the Cl, a red precipitate of copper carbide is produced, which is a convenient and sure test for acetylene. The value of $CaC_2$ being conceded, the cost is of next importance, and there are two elements of this: First, material, and second, energy. Unfortunately, many of the earlier estimates seem to be based on the cheapness of the materials used, without reference to the fact that by far the greater part of the expense is required for the electrical heat energy that is consumed.

The materials, lime (CaO), 56 per cent., 1,740 pounds, and the coke ($C_3$), 44 per cent., or 1,364 pounds, for one ton of carbide, should not generally cost over $5. Not long ago it was common to refer to this energy simply as chemical affinity and to account for chemical reactions being easy or difficult or even impossible by such vague expressions as a greater or less amount of chemical affinity. But in modern industrial chemistry and scientific research it is known that each and every possible chemical combination liberates or absorbs a definite and absolutely determinable amount of energy, which, while it exists as chemical energy, may be supplied in the form of electrical or heat energy and be exactly expressed as so many heat units. For example: In the production of hydrogen from water, to produce one pound of hydrogen energy equivalent to 34,180 practical heat units is required, or an amount of energy equal to 24 electrical horse power for one hour. We can therefore figure that to produce a single pound of hydrogen, though the nine pounds of material (water) cost nothing, still the average price for the power would be 24 cents. As the production of $CaC_2$ also involves a large deficit of heat energy, it may be interesting in this connection to review the chief electro-thermal facts and figures of the subject. The electro-thermal unit, the joule, is the amount of energy that is produced by one ampere passing one ohm in one second, or of one watt of electricity in one second, and is equal to 0 24 of the absolute heat unit. The therm, or centigrade gram calorie, is the amount of heat that will raise the temperature of one gram of water one centigrade degree. Now one electrical horse power hour equals 746 watts, multiplied by 3,600 seconds, equals 2,685,600 joules, multiplied by 0.24 equals 644 544 therms, which, reduced to the practical unit, the pound calorie, equals 1,421; that is, one horse power hour represents an amount of heat which will raise 1,421 pounds of water one degree C., or one pound of water 1,421 degrees C.

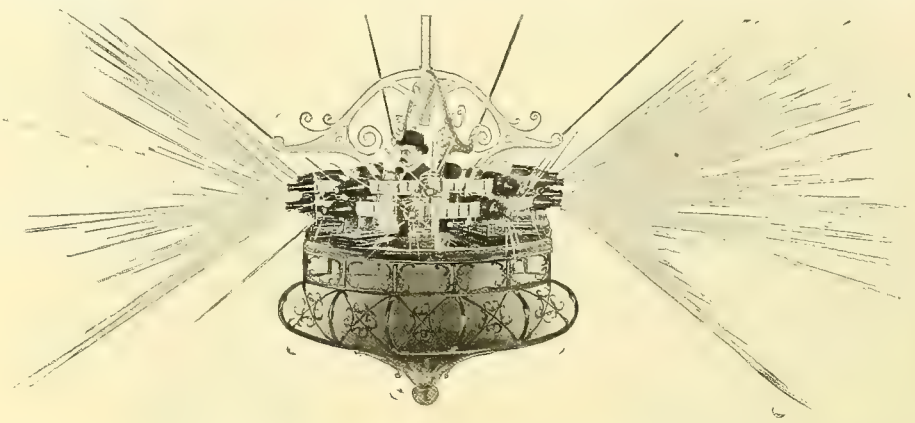

FIG. 3. CHASE ELECTRIC CYCLORAMA.—FINISHED INSTRUMENT.

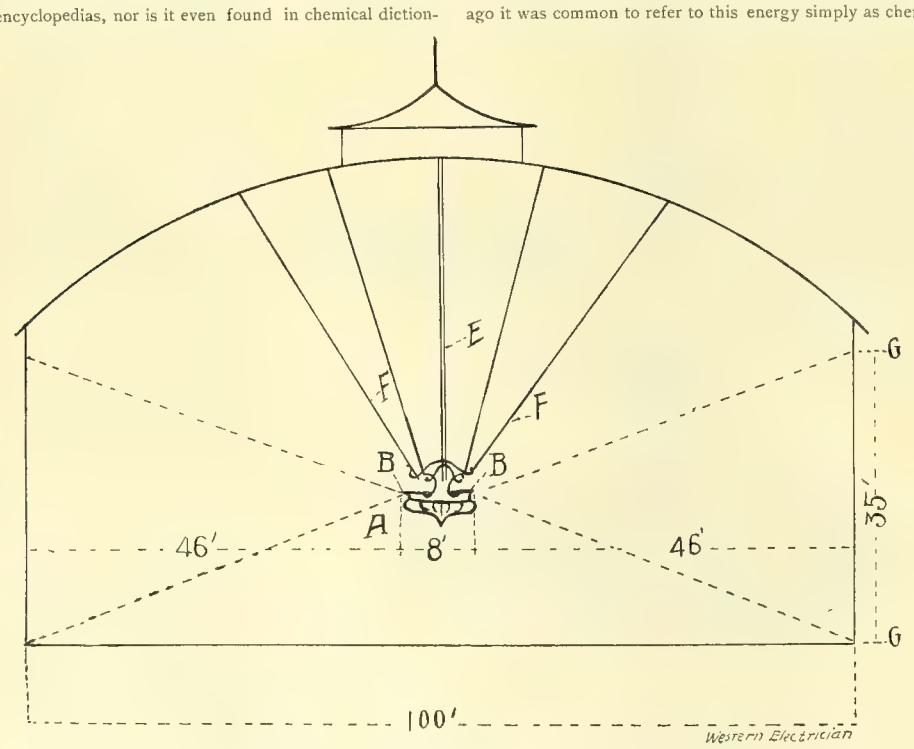


FIG. 2. CHASE ELECTRIC CYCLORAMA.—SECTION THROUGH BUILDING.

Further, as most substances we deal with have a specific heat much less than water, a given amount of heat will raise them to a correspondingly higher temperature. Thus the mean specific heat of carbon between zero and 3,000 degrees centigrade is 0.4, and 1,421 calories will therefore raise one pound of carbon to 3,352 degrees centigrade.

But it is not only the separating of elements or breaking up of compounds that require energy to be supplied, but also the combining of elements to form a most important class of compounds which includes all the compounds of nitrogen, cyanides, ammonia, nitrates, etc., as well as most of the compounds of carbon as carbon disulphide and most of the organic radicals and acids, and of this class acetylene is a representative and characteristic compound and involves energy enough in its formation to make it a most desirable base from which any of the others may easily be formed. Acetylene requires the equivalent of 63 500 heat units for its formation, while cyanogen (CN) absorbs a little more, 65,500 and most all the other compounds considerably less. Calcium carbide requires not only the heat of 130,900 calories for smelting the Ca from its oxide, but also 33,500 additional for combining the carbon to form the $CaC_2$, so that 64 pounds $CaC_2$ actually contains an amount of energy equal to 164,400 calories. The frequent occurrence of carbide when Ca or aluminum are smelted in the presence of an excess of carbon may have led to the supposition that there was a positive affinity between the metals and the carbon, but such is not the case, for if there was not a decided negative affinity it would not be possible to smelt the volatile metals, sodium, potassium, phophorus or even zinc as the vapors would recombine and decompose the carbonic oxide gas; indeed this does occur to some extent, but as it requires a large amount of heat only a small p rtion of the carbide is formed.

The reaction between acetylene and melted calcium liberates 30,000 heat units, but this is not produced by combining with the Ca, but by the breaking up of the $C_2H_2$; the reaction of $(CaC_2)+(H_2O)=(CaO)+(C_2H_2)$ requires 68,360 heat units to decompose the water and 63 500 to produce the $C_2H_2$ or 131,860, which is slightly more than the formation of the lime would produce, but the $C_2$ is already formed to take its place in the acetylene, and so the reaction goes on easily with cold water and also liberates a large amount of heat.

Now as 64 pounds $CaC_2$ absorbs 164 400 heat units or 2,569 heat units per pound, and as one electrical horse power hour can produce 1,421 heat units, each pound will actually contain energy equal to 1.8 horse power hours; but as only the heat in excess of the amount that would raise the temperature to 5,000 degrees C. (the temperature at which the reaction takes place) is available for supplying the heat energy absorbed by the compound, the cost of

production also includes the heat required to raise the mass to 5 000 degrees, and from the specific heats of the mixture we find its caloric capacity to be 31; that is, an atomic weight 92 pounds would absorb 31 heat units for every degree rise in temperature or 155,000 heat units for 5,000 degrees, but as the formation of CO by the combination of one part of the carbon with the oxygen of the lime produces 29,000 heat units and the materials may also be considerably heated when put into the furnace, this may be reduced to about 100,000 heat units, or represent 1.2 horse power hours per pound. We thus see that calcium carbide can be produced by an expenditure of three horse power hours per pound, and as the operation is simple and all the conditions of it favorable for utilizing most of the heat, there need be no question in practice about producing one pound of carbide for every four horse power expended in one hour, and from this we should be able to figure the cost under various circumstances. Perhaps the average cost of steam power is about one cent per horse power hour, which would make carbide cost $85 per ton, while power should be produced for about one-half this price or $45 a year per horse power, and we see in a year one horse power should produce about one ton, and any surplus electric power that did not exceed this cost is likely to find profitable employment in this line. An European factory utilizing water power at Neuhausen, recently started, is at present selling carbide at $90 per ton.

The remarkable fact that acetylene produces about 16 times as much light as ordinary coal gas is only partly explained by the fact that it contains much more carbon than the ordinary gas, for its combustion produces much more heat that the simple burning of an equivalent weight of hydrogen and carbon in any other form; but what is of far greater importance is the still larger percentage of the energy that is given off as light. When burned under proper pressure and diluted with 60 per cent. of inert nitrogen, more than 11 per cent. of the energy produced is available as light and exceeds in this respect even the arc light. In burning 26 pounds of acetylene 228,000 heat units are produced, while if only the 63,500 heat units involved in the combination of its elements could all be applied to the carbon atoms it would still be enough to raise them to the brightest incandescence without any combustion.

We thus see that acetylene has some right to the title of the ideal illuminant. It is certainly the ideal gas. Even at $88 per ton of carbide, the illuminating value would compare favorably with ordinary gas at 50 cents per 1,000 feet, as a ton of carbide will make 11,000 cubic feet of acetylene, which is 16 times as valuable, and with cheap power this might easily be reduced one-half; indeed, it would show great economy to consume ordinary gas in gas engines and use the power to make acetylene. But if acetylene is cheap enough to burn, it certainly has the greatest future for other purposes. It can readily be combined chemically with nitrogen from the air to form cynides and ammonia, for which there is a limitless demand and a consumption of millions of dollars worth annually. Thus the manufacture of alcohol synthetically is at once a practical and commercial operation, and the process is very simple and easily understood. If instead of water we treat the $CaC_2$ with steam and some phosphoreted hydrogen the reaction does not produce acetylene or ethine, but ethene or ethylene ($C_2H_4$), and this gas is readily absorbed by strong hot sulphuric acid to form ethylsulphate ($C_2H_5HSO_4$) and when this is diluted with water the acid lets loose ($C_2H_6O$) alcohol, which may readily be distilled off. Now besides the 64 pounds $CaC_2$ the nine pounds ($PH_3$) is required to furnish the nascent hydrogen and is the cheapest and most practical form in which it can be supplied and would not cost more than 50 cents with the carbide at two cents a pound, or $1.28 or $1.78 worth of material consumed to produce 46 pounds, or about seven gallons, of absolutely pure alcohol without any possibility of fusel oils and other products of organic decay and decomposition; it is thus possible to make as good whisky in 20 minutes as can be made by fermentation in 20 years.

The reaction $(CaC_2)+5\ S=(CaS) + 2\ (CS_2)$ with 64 pounds $CaC_2$ and 160 pounds sulphur will produce 142 pounds of the important reagent and valuable solvent carbon disulphide at less than two cents per pound. The same electrolytic cell that furnishes the phosphoreted hydrogen at the other electrode easily converts $C_2H_2$ first into oxalic acid and the other organic acids. To even mention the uses that cheap acetylene will be put to, by far transcends the limits of this article. But there is one other reaction which promises the most startling developments; that is, that calcium carbide will reduce aluminum from its oxide, alumina, thus:

$(Al_2O_3) + 3\ (CaC_2) = 3\ (CaO) + 6\ C + 2\ Al.$

This reaction is thermally positive by 100,000 calories, and various means may be employed to take up the carbon and prevent the formation of aluminum carbide, and 190 pounds of carbide at two cents and 92 pounds of aluminum at one cent a pound would make 54 pounds of aluminum cost $4.76, or say less than 10 cents per pound.

There need be no further question as to whether calcium carbide is a chemical curiosity or a commercial commodity.

FIG. 4. CHASE ELECTRIC CYCLORAMA.—INSTRUMENT IN EXHIBITION BUILDING.

## Dr. Franklin's Scientific Attainments.

[From the Boston *Pilot.*]

It is remarkable that there is not in existence a biography of Benjamin Franklin which gives a complete account of the inventions and scientific discoveries made by the versatile genius who is rightly called "the brains of the American Revolution." Great as was Franklin as a diplomat and statesman, he was greater as a scientist in the domain of physics, wherein he planted seeds which bore fruit in his own time, and again in our generation.

His pet study, electricity, which in the eighteenth century was a diversion of schoolmen, has become a gigantic industry, affording employment for nearly 2,000,000 persons in the civilized parts of the earth. To Franklin are we indebted for many things which remained fallow in the science of electricity, until Davy, Faraday, Edison, Brush, Thomson and Tesla began to pick up the threads which Franklin left in the bloom of life, when he was summoned from earth. Within two years an expensive litigation between two joint stock companies concerning the right to use a certain submarine electric machine for blowing up ledges and sunken wrecks was brought to an end when evidence was introduced showing that Franklin used similar apparatus in the Delaware river in 1787. Many of his inventions have been patented over and over again in our Patent Office, where articles in daily use by the cave dwellers may be patented by any person foolish enough to consider a United States patent of any value, and who does not know that the 400 patents taken out by Edison have been "pirated" under the protection of United States laws, which are apparently made for the profit of infringers of patents and for the bankrupting of inventors. Franklin's electrical inventions number 18, all made when his intellectual faculties were brightest.

## Emergency Brake Problem.

By Walter E. Harrington.

The instructions furnished by the manufacturers of electric street railway motors, covering the method of emergency reversal, by throwing overhead or main trolley switch and then reversing, throwing motors into multiple relation, followed by the momentum of the car running one motor as a generator and the other motor as a motor thereto, has not been very successful. Repeated cases have been observed wherein the motors failed to act upon throwing the switches as above described.

Messrs. Markle and Thompson of Hazleton, Pa., C. H. Hutchings of Wilmington, Del., C. F. Uebelacker of Jersey City, E. J. Moore of Trenton, N. J., and others have noticed the fact that motors fail at times to act when switches are thrown as above described.

Cases have been cited where the Sperry or Bonta brake system was employed, in which the plan would operate excellently when the "day was early and the brush contact on commutator good, yet at the end of the day, when the brush contact would be bad, due to dirty and burned condition of commutator, the system would fail." Failure was ascribed, and very properly, to the inability of the motor to "build up," owing to high resistance in circuit. While this failure to "build up" is well known in central station practice, it has only very recently been observed in street railway motors when employed on the self-braking principle.

It occurred to the writer that if the motors were given an initial magnetization, the Sperry or Bonta action would, of course, be obtained. To test this, automatic magnetic circuit breakers were placed on different cars on different railways, with conditions varying, using equipments and cars of various makes and sizes. The magnetic circuit breaker employed was one designed by the writer, wherein all arcing at the main switch break is entirely prevented by the use of a small copper fuse in shunt thereto.

The idea is that by using an automatic magnetic circuit breaker on a trolley car, instead of taking the valuable time, when seconds are hours, to throw the overhead switch to immediately reverse up to multiple position, of course the rush of current from line will open the car magnetic circuit breaker, thus saving power house. The very current that opened the car circuit breaker will give the motor or motors their initial magnetization, followed by the Sperry or Bonta action. Every test made fully confirmed this view and established without any doubt that a magnetic circuit breaker on a trolley car is a valuable adjunct, if for no other consideration than to use in event of emergency reversals.

In several tests where the magnetic circuit breaker was set low, say at 100 amperes adjustment, on, say, G E 1200 equipments, upon reversal, while motors were still in series relation in passing to the multiple relation, the magnetic circuit breaker would open. Here the copper fuse in shunt to main break of switch would enter in and contribute its share by lagging and not "blowing" until motors were in multiple and motor resistance all cut out.

Following are copies of some records of tests made, with the conclusions drawn at the time:

TESTS MADE ON CONSOLIDATED TRACTION COMPANY'S LINES, NEWARK, N. J., OCTOBER 29, 1895.

*Conditions.*—Eighteen foot car body; No. 21 A truck, 33 inch wheels; weight of car, 16,300 pounds; two No. 3 Westinghouse motors; G controllers; circuit breaker set at 150 amperes.

*Test No. 1.*—Straight track; car running about 17 miles per hour; controllers reversed full to last point. Circuit breaker opened in about one-half time took car to come to rest. Motors gave Bonta or Sperry action very satisfactorily and cars came to a standstill in about a car and a half length.

*Test No. 2.*—Same conditions. Circuit breaker opened, but fuse did not "blow" until car came to rest. Car stopped in about one and one-half length.

*Test No. 3.*—Same conditions with the exception car reversed by throwing hood switch. Car checked O. K. in about car length and a half.

*Test No. 4.*—Car circuit breaker set 125 amperes and placed in circuit with Weston ammeter, reading 150 amperes. Reversed to third point; ammeter indicated 75 amperes. Car stopped satisfactorily.

*Test No. 5.*—Running about 10 miles per hour. Reversed full into multiple position of controller. Circuit breaker opened but fuse shunt did not "blow" until car just about came to rest. Could only account for this action owing to the armature revolving in the opposite direction, developing counter electromotive force.

*Test No. 6.*—Reversed. Opened circuit breaker. Stopped car in three quarters of a car length. Track sanded. Conditions very severe and Bonta or Sperry action very pronounced.

*Test No. 7.*—Car running about 15 miles per hour. Reversed full. Circuit breaker opened; almost immediately followed by "blowing" of fuse. Car came to a full stop in about a car length. Bonta or Sperry action very good. Car wheels of the motor, running as a motor from the other motor acting as a generator, continued to revolve from 10 to 20 revolutions after car came to a standstill.

*Conclusion.*—The conclusions drawn from the above tests

at the time were that a car circuit breaker would give a satisfactory reversal of car even after circuit breaker had opened, owing to the initial magnetization obtained by motors from same current that opened the circuit breaker.

TEST MADE ON NEWARK ROAD, NOVEMBER 1, 1895.

*Conditions.*—Double truck, McGuire type. Two No. 3 Westinghouse motors. G controller. Car body 24 feet long. Gilbert Car Manufacturing company's make. Weight 20,620 pounds. Tandem brakes. Circuit breaker set for 125 amperes. No. 20 primary fuse in shunt to jaws of switch.

*Test No. 1.*—Car on level track, running about 15 miles an hour. Reversed in series. Circuit breaker did not open. Car checked. Continued to reverse full to multiple position. Circuit breaker opened, followed by blowing of fuse. Car came to a rest O. K.

*Test No. 2.*—Similar conditions. Circuit breaker did not open until controller was thrown into multiple relation, when circuit breaker and fuse opened some little time before car came to rest. Bonta or Sperry action quite pronounced.

*Test No. 5.*—Reversed quickly to multiple relation. Circuit breaker and fuse opened almost simultaneously, and car came to rest on Bonta or Sperry action in a very pronounced manner in about one car length.

*Test No. 6.*—Test similar to No. 2. Executed in the same manner.

*Test No. 7.*—Car running about 10 miles an hour. Reversed on first and second points. Circuit breaker did not open. Car came to a standstill.

*Conclusion.*—The above tests demonstrate that with above weight of car and circuit breaker set at 125 amperes, that with reversal on series, parallel controller in the first position, where motors are in series, circuit breaker would not open; were circuit breakers in multiple relation, circuit breaker would open, but car would come to standstill in every instance by reason of Bonta or Sperry action of motors.

TESTS MADE ON CITY RAILWAY, WILMINGTON, DEL., OCTOBER 31, 1895.

*Conditions.*—Car body 20 feet six inches. St. Louis make. No. 3 Westinghouse motors. G controller. Brill truck. Weight of car, 18,000 pounds. Tests were made running down a 5 per cent. grade; track wet and more or less covered with autumn leaves. In all the tests the speed at reversal was about 10 to 12 miles per hour.

*Test No. 1.*—Reversed to multiple. Circuit breaker opened and fuse "blew" a little before car came to rest. Motors acted on Bonta or Sperry principle very satisfactorily.

*Test No. 2.*—Connected with Weston ammetor. Reversed. Circuit breaker opened and fuse "blew" some little time before car stopped. Sperry and Bonta action very pronounced. Could not read ammeter on account of jumps. Car came to rest in about a car length. That is, the momentum was overcome and the hand brakes could then hold the car.

*Test No. 3.*—Reversed and motors flashed to ground. Circuit breaker opened from the grounding of motor more than other cause. This was noticed by reason of the pronounced manner in which the circuit breaker acted, not withstanding the car was brought to a standstill in about the same conditions recorded in above test.

*Conclusion.*—The above tests demonstrate that 125 ampere adjustment is ample for car under the above conditions, and that a car would be brought to rest under the different conditions which would be imposed upon it in practice.

## Electric Railway Men at Ottawa.

One of the echoes of the last convention of the American Street Railway association at Montreal comes in the form of a handsome photographic souvenir of the pleasant trip of the delegates to Ottawa at the close of the convention. On its arrival in Ottawa the delegation was cordially welcomed by a committee of prominent citizens, and special cars were provided by the Ottawa Electric Railway company to convey the visitors to the Parliament buildings, where the formal reception took place. In the Senate chamber the premier, Sir Mackenzie Bowell, made a felicitous address, in which he welcomed the visitors. Lunch was served at the Russell House, after which the special cars were boarded, and the party was carried to the street railway company's park, 2½ miles from the city, and thence to Chaudiere Falls, where the power station is located. Opportunity was given the visitors to examine the electric plant at this point, which is operated by water power, and contains many interesting features to street railway men. The representatives of the company gave their guests all the information they desired about the plans which the company has so successfully carried out. The local street railway service was pronounced admirable, and the special cars, which are herewith illustrated, were found to be extremely comfortable. Electric heaters made by Ahearn & Soper of Ottawa were used on the cars. The cars are vestibuled and equipped with Westinghouse motors. They are mounted on trucks made by the Taylor Electric Truck company of Troy, N. Y. The bodies were built by the Ottawa Car company. Readers of the WESTERN ELECTRICIAN are already acquainted with the electrical features of Ottawa through the elaborate description and illustrations published in this journal on this work. The trip to Ottawa and return was made in a special train thoroughly supplied with every convenience and luxury that could be required.

All of the 155 cars of the Metropolitan electric elevated railway in Chicago are equipped with electric heaters.

## Telephone News from the Northwest.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

The patrons of the Black Hills Telegraph & Telephone company of Deadwood, S. D., have a "kick" on the contract presented them for signature by that company. The contract provides that the lessee shall, in the event of the removal of the instrument before the year for which the contract is made is completed, pay half a rate for the remainder of the term; the company shall not be held accountable for any interferences with the working of the system until it has been given a 24 hours' notice; if the lessee does not cancel the contract at the expiration of the year it is regarded as a desire on his part to continue the service, and he cannot then cancel the contract until the end of another year. The company does not agree to keep the system in working order, and, in fact, the agreements seem to be all on the side of the patron. A protest was drawn up and signed by 49 regular subscribers of the company at a meeting of the patrons of the company.

The Inland Telephone & Telegraph company of Spokane, Wash., has offered to build a telephone line to the city water works, equip it and furnish the city service free of rent. The proposition was promptly accepted.

John Goodnow of Minneapolis is an applicant for a telephone franchise at Duluth, Minn., and offers low rates, long-distance connections with the Twin Cities and Chicago, etc. The city is figuring on selling the franchise to the highest bidder some three years hence, when the present company's franchise expires, and it is thought the franchise will not be granted. Application was made by letter, but the council ruled that an ordinance must be introduced by some member of the council, which delays matters until the next meeting.

The new Wausau Telephone company of Wausau, Wis., has begun operations. Last January the Wisconsin Telephone company was asked to reduce rates, and upon being refused the business men formed a local company to put in a system of their own. They have 121 subscribers, of whom 113 are stockholders. Their rates are $3 for business houses and $1.50 for residences. The Wisconsin Telephone company paid no attention to the new company during the progress of its construction, but a short time ago sent out notices that rates hereafter would be $1.25 for business houses and $1 for residences. It is not thought they will succeed in freezing out the new company.

The Iowa Union Telephone company is reaching out for business in several directions and incidentally heading off competition, which, though incipient at first, may grow into something formidable. At Clinton, Iowa, another company is contesting the field with that company. A line is projected from Clinton to Chicago, via Savanna. Work on this line will be begun very soon. The town of Thomson has no telephone connections in any direction, but a private line is being built from Mt. Carroll to that place. Hence the Chicago line will pass through Thomson. In fact, the Iowa Union is extending its lines to secure a controlling power in Western Illinois.

The telephone system proposed for Pierre, S. D., by George Holmes, has been standing for quite a while as it stood when he died, but the matter is being taken up and a canvass made for subscribers. The poles were all set and the wires strung when work was suspended, so that all that is left is to put in the instruments.

The People's Telephone & Telegraph company of Hot Springs, S. D., is the name of an independent telephone company which is soliciting subscribers and proposes to put in a system at Hot Springs. T. H. Barker of Providence, R. I., is interested.

The telephone franchise granted Captain Ira Harris and others in Superior, Wis., has been accepted by the company, which agrees to begin construction at once.

A new Bell telephone switchboard has been put in the police station at Cedar Rapids, Ia.

The Iowa Union Telephone company is overhauling the exchange at Waverly, Ia.

Seven men in the employ of the Marquette County Telephone company of Ishpeming, Mich., were arrested at Marquette for digging holes for telephone posts without permission of the council. The case was to test the right of the company to set poles and string wires without a franchise from the council. They had a trial by jury and were acquitted. The Marquette County Telephone company is rapidly supplanting the Bell company at Ishpeming, Mich. A large number of subscribers to the Bell company have had their instruments taken out. The feeling is not very favorable to the Bell company, and the recent reduction is considered to be owing to the new company. The new company has nearly 200 instruments in operation, and is increasing its list steadily.

Hon. W. H. Butler is canvassing La Crosse, Wis., in the interest of the Western Electric Telephone company of Britt, Ia. The company proposes to connect with La Crosse from Albert Lea, Minn., this season.

ELECTRIC RAILWAY MEN AT OTTAWA.

A. L. Babcock, E. N. Hungerford, C. M. Bair, Lewis Fenske, Christian Yegen, Dr. H. Chapple and Charles Spear have formed a company with $10,000 capital at Billings, Mont., and will put in a telephone exchange. They have secured 58 subscribers.

George W. Williams of Olivet, S. D., has secured the right of way from the commissioners of Hutchinson county, S. D., to construct 100 miles of telephone lines. Every town in the county will have connection with the county seat.

It is rumored that the Nebraska Telephone company will withdraw its lines from Spearfish, S. D., in the Black Hills, owing to the number of discontinuances, and the same will be done at Hill City, Hot Springs, Custer and Sturgis. About 90 of the Deadwood, S. D., patrons have signed contracts, so the system will remain there.

The Sheboygan, Wis., city council has refused a franchise to the Wisconsin Telephone company repeatedly, and recently refused permission to set poles until the franchise was granted. The company has operated there for some time without a franchise, and sought to put up more poles without permission, but the workmen were arrested. The Northwestern Telephone & Electric company of Milwaukee is an applicant for a franchise there.

T. O'Connor and others of Renville, Minn., have a telephone line running from Beaver Falls, Minn., to Renville, Minn., but it hardly pays and they contemplate extending it to Olivia, via Morton.

The Iowa Union and the Cedar Valley Telephone companies have locked horns at Waterloo, Ia., the former having made a rate of $1 per month.

The telephone line between Rome and La Hoyt, Ia., for the most part consists of wire fence except for the road crossings.

A. J. Busch has applied for an injunction against the

Northwestern Telephone company at Mankato, Minn., to restrain it from erecting a pole in front of his business property, alleging that it is unsightly and dangerous, that it will endanger the life and limb of himself, his family and all who pass or enter the premises, that it will obstruct the light and air, and is likely to fall against his building, and exposes the place to constant danger from fire. A previous action was begun in July, but he claims the company agreed never to attempt to put up the pole if the action was withdrawn.

Kaufman, Plowman & Newberry of Chicago secured the contract to put in a telephone system for the new local company at Marshalltown, Ia. The plant will be equipped for 300 instruments, with cables and wires for 100 additional. The rates asked will be $2 for offices and $1.50 for residences. It is to be completed in 60 days.

The report of the grand jury at St. Paul recommends that the city council take steps to compel the telephone company to furnish the city and county with telephone service free. It cites the case of St. Louis, where the city is paid a percentage of the income of the company, netting the city about $1,000 per month.

In applying for a telephone franchise at Duluth, Minn., the Lake Superior Telephone company stated that the company has plants at Pittsburg, Washington, Baltimore and Philadelphia. Mayor Lewis, therefore, wrote to the mayors of those cities about the matter and was answered from Baltimore and Pittsburg, that there was but one company operating in each of those cities and that was the Bell company.

Deadwood and Rapid City, S. D., are the only cities in the Black Hills which have a telephone exchange in operation, all the others now being reduced to toll stations. Between 15 and 20 subscribers in Deadwood and Leadville gave up their telephones rather than sign the odious contract required.

The court has ordered connections to be made between the long-distance wires of the Wisconsin Telephone company at Waukesha, Wis., and those of the National Telephone company at that place. Public sentiment is in favor of the new company, even though its service at present is not as good as that of the old company.

The Phœnix Telephone company will soon begin construction work on its exchange at Mankato, Minn. It expects to have the system in operation in two weeks from the time work begins.

The approach of the completion of the Oshkosh Northwestern Telephone company's exchange at Oshkosh, Wis., brings prospects for a telephone war there. The Wisconsin Telephone company announces that it will give the cheapest service if it is necessary to furnish telephones for one year free. The present rate of the Wisconsin Telephone company is $24 for houses and $36 for offices. The Northwestern's rate is $18 for houses and $24 for offices.

The city council at Marquette, Mich., is at loggerheads with the Marquette County Telephone company, and has passed two ordinances requiring wires to go underground in a certain district, both of which were promptly vetoed and the first was also declared unconstitutional by the courts. A petition from 85 citizens of the city to grant the company a franchise was laid on the table.

J. E. Tomlinson of Centerville, S. D., and W. A. Cottrell of Sioux City, Ia., have been projecting a telephone line to run from Parker, S. D., to Sioux City, and it is now announced that the line is a certainty. Stock will be sold for $8,000, which is the estimated cost of the line.

It is understood that the Standard Telephone & Electric company of Madison, Wis., will put in a system at Chippewa Falls, Wis.

Ex-Congressman Walt H. Butler, representing the Western Electric Telephone company of Britt, Ia., is arranging to have a telephone system built from Albert Lea, Minn., to La Crosse, Wis., via the Southern Minnesota Railway to Rushford, Money Creek, and Houston, Minn. Another line is projected from Preston, Minn., to Caledonia, Sheldon, and connecting with the first line at Houston.

Phillip Loewe of Chippewa Falls, Wis., secured a franchise for a telephone system. The Standard Telephone & Electric company's instruments will be used.

Manager Buchholz, of the Northwestern Telephone exchange at Mankota, Minn. gives it out that his company is not frightened at the appearance of the Phœnix Telephone company in that field, but will make a number of improvements in their system. If the latter company puts down prices, as they claim they will do, to $2 and $1.50, he says his company will cut to $1.50 and $1.

The Northwestern Telephone exchange has secured a right of way for its long-distance line from St. Cloud, Minn., to Little Falls, Minn., and will build the line at once. It will ultimately be extended to Fargo, N. D. The St. Cloud exchange is to be rebuilt.

The company at West Superior, Wis., which recently secured a franchise there, will soon incorporate as the Lake Superior Telephone company. It is waiting to fix up a franchise at Duluth, and announces an intention to compete with the Bell company.

The long-distance telephone between Hillsboro, Mayville and Portland, N. D., is completed and the line from Fargo to Grand Forks nearly so.

The Northwestern Telephone exchange in Minneapolis has located its proposed sub-exchange in the Eighth ward at First avenue South and Twenty-sixth street. Poles have been set along Twenty-sixth street and wires are being strung.

The Blue Earth Valley Telephone exchange of Winnebago City, Minn., proposes to put in an exchange at Blue Earth City, Minn.

The Northwestern Telephone and Electric Company of Milwaukee, which has secured a franchise at Ashland, Wis., announces that it will have the Ashland exchange in operation by January 1st., Work will be begun at once. It has secured over 75 subscribers.

The Nebraska Telephone company has reduced the telephone rates in the Black Hills, South Dakota, district.

Work has begun on the Dane County Telephone company's line at Madison, Wis., and the company expects to begin operations January 1st with nearly 400 subscribers.

The Northwest Engineering company of St. Paul is arranging to put in a telephone system at Fairmont, Minn.

It is understood that the Northwestern Telephone exchange will extend a toll line from Mankato, Minn., to New Ulm. The entire Mankato line is to be reconstructed also.

The contract has been let for a telephone line from Sherburn to Fairmount, Minn., and work is being rushed.

The Winona Telephone company of Winona, Minn., now

P. M. MC LAREN.

has 350 instruments in use, and connects with 10 surrounding towns.

The Northwestern Telephone exchange is rushing work on a line from Winona, Minn., to La Crosse, Wis., and has four miles to build.

Negotiations are about completed at Trempeleau, Wis., to build a telephone line to Centerville, Wis., where connection with the Luce-Vietch line will be made, and with the Northwestern Telephone company's line to Chicago.

The Rocky Mountain Bell Telephone company in Great Falls makes a rate of $18 per year where a party line with six connections is used.

It is rumored that a second telephone line will be built from Winona, Minn., to La Crosse, Wis., by the La Crosse Telephone company and the Winona Telephone company, both being independent of the Bell company.

Telephone connection is completed between Blue Earth City, Minn., and Winnebago City.

The Iowa Union Telephone company will soon build lines from Mason City to Hampton, Ia.

D. A. Wagner is canvassing Albert Lea, Minn., in the interest of a telephone company which proposes to build a system from Cedar Rapids, Ia., to Minneapolis and St. Paul. The line will pass via. Albert Lea and Waseca, or Austin and Owatonna, Minn., depending on the patronage secured. Mr. Wagner thinks the prospects for success are good.

The Southwestern Minnesota Telephone company has let the contract for a telephone line between Sherburn and Fairmont, Minn., by way of Welcome, and it will be in working order this month. The company expects to extend to Jackson this fall.

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The St. Paul Gas Light company of St. Paul has sold its gas and electric light plants, franchises, etc., to eastern parties.

## P. M. McLaren.

Among the allied interests of the electrical business there is none which bears a closer relation to it than that of the steam boiler trade, as the cost of producing electric light and power is largely dependent upon the cost of the steam power generated.

There are but few more widely known men in the country in this line of business than P. M. McLaren of New York, who for over 25 years has been closely identified with all important features of the boiler business. Mr. McLaren came to this country from Scotland in 1879, having previously been connected in general engineering business in Scotland and England. He was for about two years connected with the Strong Feed Water Heater & Filter company of Boston, Mass., after which he accepted the position of general eastern and special agent for the well-known water-tube boiler of the Babcock & Wilcox company of New York, with which he was connected for about 10 years. Later he accepted a flattering offer from the Abendroth & Root Manufacturing company of New York as general sales agent, which position he has held for the last two years. An idea of the territory covered by Mr. McLaren is indicated by the fact that he traveled somewhat over 31,000 miles in 1894.

Mr. McLaren, appreciating that the electrical business was one of the interests which would develop in great proportions, gave up a large share of his time to this industry from the beginning. There are probably few if any gentlemen who have traveled as many miles and sold as many boilers to the electrical trade as he. He installed boilers at the laboratory and also the ore mines at Ogden, N. J., for Thos. A. Edison. Among the best known installations of boilers is that of the Edison Illuminating company of New York, which placed the order through Mr. McLaren. Other contracts with the Arlington Mills of Lawrence, Mass., the office buildings of the New York Life Insurance company located in Kansas City, Omaha, St. Paul, Minneapolis and Montreal, the Produce Exchange and other prominent buildings in New York, the capitol at Washington, and the Royal Electric Lighting company of Montreal were also taken through his efforts. Mr. McLaren is a very pleasant and agreeable companion, and but few enjoy a more deserved popularity and extensive acquaintance in the electrical trade.

## Mr. Pope and the Institute.

In the last number of the *Transactions* of the American Institute of Electrical Engineers a brief obituary notice and portrait of Franklin Leonard Pope were printed. The same number contained Mr. Pope's latest contribution to the proceedings of the Institute, his paper entitled "Notes on the Reconstruction of a Small Central Station Plant," presented at the twelfth general meeting of the organization, which was held at Niagara Falls on June 27th. This paper has already appeared in this journal.

## Electrically Sealed Champagne Bottles.

In a recent number of *La Nature*, M. A. M. Villon describes a novel method of sealing champagne bottles. The loss and deterioration of champagne due to the escape of gas has long, he says, made some process of perfect air-tight sealing desirable. M. Villon accomplishes this by covering the cork and part of the neck with a thin layer of copper electrically deposited. For this purpose the neck of the bottle is coated with a conducting substance such as black-lead, zinc or copper powder, and plunged in a galvanic bath. This bath has a cover of paraffined wood with conical holes, which are lined with copper rings. All these rings are connected among themselves, and with the negative pole of the dynamo, while a copper sheet in the bath is connected to the positive pole. The bottles are simply inserted in the holes, neck down, and when a layer of two-tenths to three-tenths of a millimeter has been deposited the current is stopped. The deposit may be gilt or silvered, or given any desired shade in special baths. The process, of course, can be employed to seal bottles for mineral waters, preserves, and a variety of products.

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The Supreme Court of South Dakota has handed down a decision, the effect of which is that the Western Union Telegraph company is not compelled to receive a message for transmission unless it is written on a blank of the company. It was on a test case involving the reasonableness of the demands of the company on the printed blanks.

The new cable connecting Havana with Santiago de Cuba by way of Casilde, Jucaro, Tunas, Santa Cruz and Manzanillo, which is now being laid by the Cuba Cable company, will be completed and in operation soon. The company, which has its headquarters in London, is indirectly under the control of the Spanish government, and the cable will be of great service to that government in the prosecution of the war in Cuba. Many of the places which will be brought into communication with Havana by the new cable have been practically cut off from the rest of the world heretofore. Since February 16th the land telegraph lines in the eastern part of Cuba have not been in working order, and, consequently, the commanders near the seaboard have had great difficulty in communicating with the troops in the interior. News from the towns and cities on the coast could be obtained only by means of mail steamers.

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By the decision of the Supreme Court of the United States on Monday the Berliner patent litigation will be reviewed by that tribunal. This will naturally be followed by increased activity in telephone circles, as the Bell company will not now be able to use this patent as a club with which to drive competition from the field. Of course the outside companies are jubilant over the decision, as it gives them practically a guarantee against intimidation for at least three years, for, it is believed, it may take that much time to reach a final decision.

SOMETHING must be done by street railway companies in large cities to relieve the crowded condition of their cars at certain hours of the day, especially at the close of business. At that time in Chicago cars on all the principal lines are crowded, passengers are compelled to stand up, hold on straps or wait on the street corner until the rush is over. Complaints are growing more frequent and emphatic, but there seems no way out of the difficulty until elevated lines are established for every section of the city. Express trains can be run upon these at a higher rate of speed than would be possible on surface lines. When this [illegible] possible for the companies to provide better accommodations than the service at present affords. It has been suggested that parlor cars be attached to the regular trains, these cars being fitted with single seats and plenty of room being provided for passengers to enjoy reading the evening paper while returning to their homes at the close of the day. There are a great many men who would pay an additional fee for these little comforts. In a city like this where so much time is passed in riding on street cars, suburban trains and the elevated roads, everything tending to remove the discomforts of travel is appreciated and encouraged.

ONE of the results of last week's election was the return to Congress of the Hon. Amos J. Cummings, who served for a short period as member of the Board of Electrical Control of New York. We congratulate Congressman Cummings upon his election, for it places him in a position where he can serve his constituents to some purpose. As member of the Board of Electrical Control he was occupying a purely political position, and having neither inclination nor training for the office, he could not do justice to himself nor could he give valuable service to the city. In Congress he has made a splendid record, and we have no doubt that he will add to his reputation on his return to Washington.

IT would seem as if the limit had been attained by that class of "inventors" whose occupation consists principally of modifying standard articles of electrical apparatus or changing the form of construction or appearance of the completed article without in anyway improving the device or substituting new principles. The records of the Patent Office bear evidence of the ingenuity of these men. They do not work on original lines, nor do they produce articles that show research or scientific experiment. They prefer to follow the lines laid down by others and if possible appropriate the fruits of their neighbors' toil. Their occupation can scarcely be considered legitimate, but they consider themselves "inventors" and they are not overburdened with modesty in asserting their claims. Our patent system really offers encouragement to this class, and many of them thrive where far abler men struggle for a bare existence.

ANOTHER decision has been added to the list of incandescent lamp cases, already too long. This time the United States Supreme Court decided the important case of the Consolidated Electric Light company against the McKeesport Light company in favor of the defendants. The court holds the Sawyer-Man patent invalid. The decision was handed down by Justice Brown. The case of the Consolidated Electric Light company against the McKeesport Light company involved the claims of Sawyer and Man and Thomas A. Edison to priority of application of the principle of incandescing carbon conductors made of fibrous or textile substances to electric lighting. In the opinion Justice Brown said that the claims made by Sawyer and Man were too broad, covering, as they did, all fibrous material, unless the same general quality with respect to their character as conductors could be shown, which was not the case. If Sawyer and Man had only asked for a patent on the carbonized paper the case would have been different, but as it was, their claim was not sufficiently specific. This case has been in litigation since 1887. The patent upon which the case was begun has already expired.

THERE are a good many reasons why the plan of the Chicago General Railway company to acquire wherever practicable the right of way by purchase of property appeals to street railway men, especially those operating lines that extend into suburban districts where land can be purchased cheaply and high speed is very desirable. Other companies have considered the subject, but nowhere, to our knowledge, has the plan been adopted in a large city. The nearest approach to this plan is that followed by the trolley line between Orange and South Orange, which is about three miles long at present, and is built entirely through private property. It is proposed to run cars over the road at the rate of 30 miles an hour or more. The part of the road so far completed has cost over $100,000, including an arched tunnel in Orange, which alone cost over $10,000. The road passes through one of the most picturesque parts of the Oranges. The line crosses and recrosses the east branch of the Rahway river, over substantial bridges, in a serpentine course. There seems to be no question in the minds of the men backing these enterprises that the roads can be made to pay. Of course in large places the conditions would be greatly altered. Values have reached such a high point in business districts of large cities that it would be out of the question for street railway companies to buy their right of way down town. In a good many cases in New England, it seems, this plan ought to prove practicable, especially in railways connecting small towns. This, too, would relieve the companies of much of their embarrassment on account of the legislation that has been passed to "regulate" them out of business.

THOSE who know John P. Barrett best will not be surprised to learn that he has signified his intention of passing over the criticisms that have been made upon his policy his methods and his work as city electrician of Chicago. Many would have been greatly surprised had he undertaken a defense or explanation of his record in public office. But there were some who retained some slight regard for the "professor" and earnestly wished that he would take up the matter and make an honest endeavor to clear his record before closing his public career. Those persons, it is evident, were not familiar with all the facts or the character of the officeholder. There can be no doubt that Barrett has been deeply wounded by the exposure of the failure of his plans, and if he dared invite further discussion of the subject he would unquestionably attempt a defense. But no one realizes more fully than he the folly of such a course, and he has therefore attempted to distract attention from the main issue and has resorted to coarse jests and vulgarity in his efforts to raise a laugh. He will not deceive any one, though; on the contrary he is giving the public a true insight into his real character. It is true that he is only a politician and not a very scrupulous one either, and on that account little is expected of him, but it seems as if that instinct which in men of his class takes the place of reason and judgment possessed by those more highly favored by nature or circumstances would have led him to restrain his natural inclinations and observe those social amenities which are practiced by gentlemen. Of course it was not to be expected that Barrett would give evidence of refinement or culture, for these are foreign to his nature, but as he is rather keen it was not unreasonable to expect that in the public expression of his resentment he would not entirely disregard those qualities that he must have noticed in the gentlemen with whom he is brought into contact in his official capacity or in promoting his many outside ventures.

WHEN a railroad commission in a large eastern city made an examination into the subject of fenders for street cars it reported that the only practical and reliable safeguard that could be depended upon was a faithful and efficient motorman. Car fenders, the commission declared, had not reached a point of perfection where they could be relied upon. Many street railway companies in different parts of the country had experimented with numerous devices of this kind, and a great deal of money had been expended in their efforts to develop a satisfactory guard, but the commission had been unable to find one that met all the requirements of service. The commission recommended in its report that the companies continue their experiments and, in the meantime, impress upon their employes the responsibility of the positions they occupy.

In this last suggestion the street railway companies find the only practical means at their disposal at the present time to provide against calamities such as have blotted their records. In Brooklyn, for instance, the companies have been singularly unfortunate. Some of the responsibility for these accidents rests with the management of the companies, some with the motormen, and many cases were such that no provision could be made to prevent them; but for some of the accidents, it is conceded, the companies and their employes were responsible, and now the corporations are anxious to make provision against repetition of these accidents. One of the methods employed by one company is to offer a cash prize of $10,000, to be divided among the men who shall have a clean record for a year; that is, all who shall have had no accident causing either injury or damage to other persons or property, or to the company's property, and who have not been suspended for violation of the company's rules. The management did this to impress upon the employes that the success and prosperity of the company depended upon safe, regular and quick car service, together with courteous treatment of the public by its employes, and the payment of the prize money was authorized in the hope of securing more efficient and conscientious service on the part of both conductors and motormen and thus improving the service on the company's lines. There is no doubt that this plan will have a tendency to improve the service, and the company will find it a very profitable investment. There are other details of management of large companies which if looked after closely would result in general improvement. Better men should be secured and care should be taken to interest the men in their work, otherwise all the precautions and costly guards and fenders that the companies may adopt will be of no avail.

## Duty of Distributors of Electricity.

The first case in which it has been necessary for the Supreme Court of Colorado to determine the duty to the traveling public resting upon a person or corporation distributing electricity by means of wires suspended above a public street or alley, is the recent action of the Denver Consolidated Electric company against Simpson, in which a decision was rendered July 1, 1895, and a rehearing denied September 9th. Here the evidence tended to show that while the plaintiff was lawfully passing along one of the public alleys in the city, without any fault on his part, he came in contact with one of the defendant's wires, heavily charged with electricity. The wire had become disconnected from its overhead fastening, and was hanging down to within about two feet of the ground in the alley. The negligence charged against the defendant, of which there was some proof, consisted in its failure properly to construct its line, and its omission to take the necessary precautions to prevent the wires from falling and causing injury in case they became detached from their fastenings. There was a verdict for the plaintiff in the sum of $2,800, and the Supreme Court affirms the judgment of the trial court.

The employment of electricity for supplying light, the Supreme Court says, is of comparatively recent origin. The best methods of constructing lines for its distribution, and the precautionary steps to be taken to guard the public from the dangers incident to its use, may not be known or fully understood. But enough is known to justify the statement that the business of distributing electricity on wires over the streets of a city is a dangerous business, and attended with peril to travelers along the highway. The jury should have been instructed that the defendant was bound to exercise that reasonable care and caution which would be exercised by a reasonably prudent and cautious person under the same or similar circumstances. In addition to this, it should have been instructed that the care increases as the danger does, and that, where the business in question is attended with great peril to the public, the care to be exercised by the person conducting the business is commensurate with the increased danger.

Under the facts in the case, continues the Supreme Court, the law required of the defendant, conducting, as it did, a business so dangerous to the public, the highest degree of care which skill and foresight can attain, consistent with the practical conduct of its business under the known methods and the present state of the particular art. This is the measure of the duty owed by a common carrier to a passenger for hire. Not for the same reason, or because the doctrine rests upon the same principle, but with even greater force, should this rule apply to a person or a corporation engaged in the equally, if not more, dangerous business of distributing electricity throughout a city by means of wires strung over the public alleys and streets, in so far as is concerned its duty to the traveling public.

Where the facts of a case naturally lead equally intelligent persons honestly to entertain different views as to the degree of care resting upon the defendant, the court ought not to lay down a rule prescribing any particular or specific degree in that case. But where all minds concur—as they must in a case like the one under consideration—in regarding the carrying on of a business as fraught with peril to the public, inherent in the nature of the business itself, the court, it is declared, makes no mistake in defining the duty of those conducting it as the exercise of the utmost care.

## Copper Telegraph Wires.

Attention has often been called to the increase in the demand for copper caused by the extension of electrical work in various directions. An instance of a new demand for the metal which had hitherto been hardly suspected, says the *Engineering and Mining Journal*, is found in the recently issued annual report of the Western Union Telegraph company. We find there that the company, during the year ending with June last, added to its wire lines a net length of 11,859 miles, and that over 10,000 miles of the new wire is of copper. The report states, moreover, that the company has adopted the policy of replacing all defective iron wires on its line with copper, the intention being to use that metal alone on all the principal lines hereafter. The advantages of saving in weight, increased capacity for electrical transmission and diminished liability to interruption from atmospheric conditions are sufficient to make the copper wires more economical in the end, notwithstanding their greater first cost. The decision has been assisted also by the fact that the improvements in processes for drawing copper wire have enabled makers to furnish material well adapted for telegraphic use. The renewals and additions made by the Western Union company last year do not represent more than an average year's work. The size of copper used for telegraph wires is generally No. 9 or 10 B. & S., weighing about 199 pounds to the mile. This would require for 10,000 miles about 760 long tons of copper, an amount not so important in itself, but as indicating a tendency to increased demand.

A large gas engine has, says the *Gas World*, been made at Rouen; 320 indicated horse power with fuel gas, and 450 with coal gas.

## Pollak's Gleichrichter.[1]

By F. H. Mess.

The rapid extension of incandescent gas lighting during the last two years, its comparative cheapness and high degree of brilliancy, added to the now demonstrated possibility of changing its tint by varying the combination of oxides in the incandescent mantles, have combined to check the adoption of electric lighting in Germany and to force electrical companies to seek new outlets for their energy in the directions of motive power and electrolysis. The electrical central system established at Frankfort a few months ago has proven technically successful, but private consumers generally complain of its high cost, and it is already evident that the financial success of the enterprise will depend upon the more general adoption of electricity for motive and electro-chemical purposes.

These conditions have lent exceptional importance and interest to a device known as gleichrichter, or rectifier, invented by C. Pollak, a Frankfort engineer, which solves the hitherto stubborn difficulty of concerting an alternating into a direct electrical current with the loss of but a trifling percentage of its energy. Electricity is supplied at Frankfort from the municipal central station at 7¼ pfennigs (a little more than 1¾ cents) per unit, in the form of single phase alternating currents of 3,000 volts. At the accumulator works, where the Pollak system has been in successful operation for more than a year, this current is reduced by transformers to 65 volts, and then converted into a direct current by the new device.

The problem was to devise a plan by which a commutator, located at any distance from the dynamo creating alternating currents and turning synchronously therewith, should have the same effect of turning the entire current in a uniform direction—in other words, converting the alternating currents after they have passed into the outer circuit into a direct current. For this purpose the present invention employs two collector rings and two rows of commutator bars, the latter insulated from each other and the shaft and alternately connected with the rings. The alternating currents, having been received from the central station and reduced to 65 volts as mentioned, enter the machine through brushes resting on the rings. The direct current is taken off by four more rows of brushes, arranged adjustably, the first and third and the second and fourth rows being connected with each other.

The rectifier is turned by a synchronous motor of small dimensions which receives its alternating currents, likewise reduced to 65 volts, from a small special transformer provided for that purpose. The outer circuit of the continuous current which passes from the rectifier includes an automatic disconnector, fluid resistance amperemeter, and, in various parallel shunts, electric motors and cells with their voltmeters and other apparatus. The converted current produced by the rectifier is not entirely continuous, but pulsating, the length of the pulsations being governed by the width of the commutator bars and the speed of the central generator. The duration of the contact can be regulated by adjustment of the brushes, and this adjustment should be so made that the motive force of the current shall not fall below that of the battery which would otherwise discharge the current.

Four of these rectifiers, each for 350 amperes, have been in continuous service day and night at the works of the company in Frankfort for more than a year, with such complete success that the system may be fairly claimed to have passed the experimental stage. Their efficiency is stated to be 96 per cent; that is, the alternating currents are converted into a direct one with a net loss, including the slight reaction of about 2 per cent. on the transformer, of only 4 per cent.

The direct pulsating current thus created is admirably adapted for electrolytic work, it being an established principle that the induced currents resulting from such pulsations greatly promote electrolytic action. It also lights arc and incandescent burners, runs continuous motors of all sizes down to the smallest and is used for charging storage batteries, which is the chief function of the Frankfort company. The rectifier and its accessories are exceedingly compact, the whole installation, including seven transformers, occupying only about 25 square yards of space, within which compass the apparatus and its capacity might be easily doubled should occasion require. The rectifiers are small, require no other foundation than wooden trestles resting on a solid factory floor, and demand no more oversight than an ordinary dynamo. From the testimony of the numerous experts who have visited Frankfort especially to examine the system, the current supplied by the new rectifier is for all practical purposes identical in value and effects with the continuous currents hitherto produced in the ordinary manner.

1. Abstract from report of United States consul-general at Frankfort, Germany.

## Requirements of Naval Engineers.

The education of the modern naval engineer is technical in the highest degree, more so than that of any other naval officer save the naval constructor. The sudden demonstration of the fact that the engineer is a man of importance, remarks the New York *Sun*, is likely to obtain for him with good will what has hitherto been grudgingly accorded by his brothers of the line—that is, recognition of his right to rank as an officer—and the term "greaser" is likely to disappear forever from the slang of the navy. The engineer officer must know not only the science of steam engineering, but he must be a first-rate electrician as well. The knowledge that electricity demands of the modern naval engineer has made it necessary for him to add a new science to his education. It was a simple matter to look after the engines of the old Kearsarge, with her tonnage of 1,550 tons and her horse power of less than 9.00 It is a very different matter to be responsible for the Baltimore, with a tonnage of 4,600 and a horse power of over 10,000, to say nothing of her auxiliary engines and other appliances, or to have the responsibility of the chief engineer of the Minneapolis, with 7,350 of tons displacement and 21,000 horse power.

## Future of the Electric Telegraph.[1]

By P. B. Delany.

The telegraph lines of the future will be in keeping with their importance as means of communication. Iron poles, set in cement foundations, like the best trolley lines, large copper wires, protected above and below by steel guard wires of great strength, and undisputed right of way over shortest routes will be the main characteristics of the mail-carrying lines. The guard wires will be used for way stations and test offices. The copper conductors will carry through-business by the fast system. When it is once proven practicable to deliver 1,000 words per minute in plain Morse characters over a circuit 1,000 miles in length, all prejudices hedging about old systems and methods of handling business should be swept aside. A perforator and a type-writer will in effect be a sending operator and a receiving operator, and about 40 will be employed at each end of a single wire. Can it be doubted, then, that in the near future the telegraph will be the medium of general communication? Great changes have already taken place in the comparatively modern methods of correspondence. To realize this, it is not necessary to go back to the postboy on horseback, the packet boat, or the stage coach. As late as 20 years ago nearly every business man wrote his own letters, and very bad chirography jogged along by mail train at 20 miles an hour. Now, probably over 90 per cent. of the business letters are dictated to stenographers, and plain type-writer print speeds along at 40 miles an hour. The letter of the future will be dictated to a stenographer, who, instead of type-writing it, will perforate it on a paper tape. This tape will be sent to the telegraph office, where it will be put through the automatic transmitting machine, and in a second or two it will be at its destination. The receiving tape will be delivered direct, and the plain Morse characters will be translated on the type-writing machine by the correspondent's stenographer. Commercial houses having a large business will do their own perforating and translating, thus securing important reductions from the regular tolls. For them the telegraph company will be simply a carrier, having nothing to do with their correspondence but putting it through the machine. Nor will such messages be read by any of the companies' employes, any more than open letters are now read by postal clerks. This will practically render all such correspondence secret, as the perforated strip may be withdrawn as soon as it has been used. The contents will not be forced upon the notice of the telegraph operator as at present. Newspapers, railway companies, or other large corporations which now frequently have to resort to ciphers and codes to prevent "leakage" will welcome this privilege of protecting their secrets. A few weeks' practice is all that is necessary for learning to read the Morse characters with great facility from the paper tape, and proficency on the perforating machine may be reached in the same time, so that to the already varied accomplishments of the type-writer will be added perforation and translation of telegraphic correspondence. Translation from Morse characters will be easier than from stenographic notes, with none of the elements of doubt attaching to the latter. This reference invites a digression. Is it not time that boards of education took under consideration the advisability of substituting the study of the Morse alphabet and the use of the type-writing machine for some of the courses of doubtful utility now maintained in public schools? The language of dots and dashes is the only real volapük, the universal sign language, the knowledge of which would enable a deaf mute to make himself understood from Kansas to Khartoum, wherever he found a telegraph operator. If, as it would seem, all commercial correspondence is to involve stenography, type-writing, and telegraphic characters, why limit instruction to penmanship?

1. From the *Engineering Magazine*.

## Electrical Workers and Contractors Meet.

On Tuesday, November 5th, at the Tremont House, Chicago, there was a meeting between the electrical contractors of Chicago and a committee representing the Brotherhood of Electrical Mechanics, consisting of President Thomas Anderson, Secretary George Kaufman and Vice president C. B. Quealy of the Builders' Trade Council. The object of this meeting was to ascertain, if possible, if by both associations joining hands it was not feasible to put the contracting business on a better and more paying basis. A committee was appointed by the contractors consisting of Messrs. Comstock, Bret, Meacham and Frantzen to confer with the committee appointed by the Brotherhood of Electrical Workers. The committee was instructed to report as early as possible.

## Private House Lighting Plant.

A complete electric lighting plant will be erected at the residence of Frank Thomson, Merion, Pa., vice-president of the Pennsylvania Railroad company. The plant consists of an Otto gasoline engine, capable of giving 26 actual horse power. The engine is belted to a four-pole shunt-wound dynamo having a capacity of 20 kilowatts. A storage battery consisting of 60 chloride accumulator elements of type 11 G, in lead lined tanks, will be used. These cells have a capacity of 1,000 ampere-hours at a 10-hour discharge rate, but provision is made in the lead-lined tanks to double the number of plates, thereby increasing the capacity to 2,000 ampere-hours. The power house is situated about 300 yards away from the residence, the current being conveyed by a 300,000 circular mil cable run partly on poles and partly underground. The plant has been especially designed and built for private house lighting, and the whole installation

will be as complete as it is possible to make it. The contract was secured by the Electric Storage Battery company of Philadelphia.

## The Ten-word Telegram.

Although the price of telegraphic messages has been greatly reduced in the last 30 years, the 10 word custom is still strong upon the American people. An officer of the Western Union Telegraph company made two or three laborious computations as to the average length of messages other than those addressed to newspapers, and found that it was a fraction under 14 words. A like computation made several years earlier showed almost exactly the same average. There has been no very recent computation on the subject, but there is no reason to believe that the average length of telegraphic messages has increased since the average was found to be between 13 and 14 words. Users of the telegraph still resort to all sorts of devices to keep within the 10 words that entitle the messages to the lowest tariff rate.

"Smorning" still stands for "this morning" and "sevening" for "this evening," while there are 20 other abreviations employed by way of economy. The small connecting words, the articles "a" and "the," and all such superfluous decorations in English are still omitted from the ordinary literature of telegraphy. But the commonest and least reasonable form of this economy is that which leads the sender of a message to leave his thought half expressed, often to the mystification and distress of the recipient. The New York *Sun* says that nine persons ten out of treat the 10-word limit as sacred, and whether rich or poor sacrifice considerations of clearness, convenience, and certainty to the saving of a few cents.

There was sufficient excuse for economy 30 years ago, when the 25 cent rate applied to only the shorter distances and the rate for each additional word was far above the present additional word rate. The highest rate for 10 words to Western Union offices within the United States and the British provinces is now $1, and the highest additional rate is 7 cents per word. In 1866 it cost $14.05 to send a 10-word message from North Sydney, Nova Scotia, to Santa Fe, New Mexico. Such a message between those places now costs $1. The process of cheapening rates has gone on in two ways, by limitation of the maximum rate for 10 words and by extension of the area of the 25-cent message. The maximum rate in 1866 for 10 words was over $14; the maximum 10-word rate in 1872 was $5. The maximum was reduced next year to $2.50. It would have been $2, but for the fact that the people of California, who were especially interested in the rate, then used constantly a $2.50 gold piece, and the rate was fixed for convenience at the denomination of that coin. The maximum was next reduced to $2, then to $1.50, $1.25, and finally to $1.

Meanwhile the area of the 25-cent rate was steadily widened, until it came to include a whole state in New England and the Middle Atlantic states. Then came the 25-cent rate from place to point in New England, and from New York to any place in that division. The 25-cent rate is now extended to most of the densely peopled states. It has not yet reached Texas, parts of which are as distant from each other telegraphically as Portland, Me., and San Francisco. Lower rates have been made for cities and their suburbs, and there was for a brief period a 15-cent rate of pretty wide application. There is now a 10-cent rate between commercial exchanges where there is practically no delivery, the sender and the receiver each being at the elbow of the operator.

There are still many small places in the United States that can be reached only by the payment of a high rate. Such are places not on Western Union wires, reached only by way of small connecting lines, by telephone or by messenger. There are many small lines of telegraph in private hands. Some of these have been built by operators upon speculation. The Western Union company has absorbed many such as they came to have a business of some volume.

While most persons are still under the dominion of the 10-word telegraphic limit, the telegraph is used much more freely for business, and especially for social purposes, than it was 30 years ago. Men may hesitate at exceeding their 10 words but they no longer feel the expenditure of 25 cents for a dispatch asking a friend to dinner or inquiring for an invalid or ordering theater seats a reprehensible luxury. The frequent use of the telegraph for such purposes is spreading to all sorts of people. It was once confined to the well-to-do. Some cynics say that the telegraph is an excellent adjunct to courtship when the lady seems of many minds as to receiving the attentions of a gentleman. A 10-word despatch saying, "I'll come out at four, hoping you'll walk," it is said, will thoroughly fluster a coy maiden who might find excuses for declining a more formal invitation. While most persons still content themselves with infrequent 10 word messages, there are a few curious folk who write long letters by telegraph, not business letters, but letters of friendship, and even of a more tender sort. There are others who habitually use the telegraph when to all appearances the mails would serve their purpose quite as well.

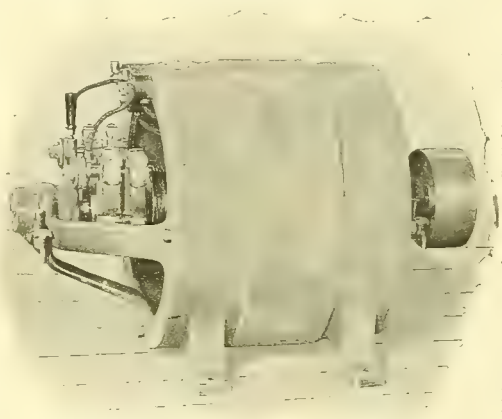
It has been observed that the telegraph is much used by business men in places far removed from great markets with which they have dealings. Perhaps one reason for the persistence of the 10-word superstition lies in the fact that telegraphic rates beyond the 25-cent 10-word rate are a mystery to the public. There is a simple method of calculation for messages beyond 10 words. The rates for 10 words are divided into groups of three—25, 30, 35; 40 45, 50; 55, 60, 65—and the middle rate of the group is to be divided by 15 to obtain the additional word rate. Thus the additional word rate for places to which the rate for 10 words is 25, 30 or 35, is two cents; for points to which it is 40, 45 or 50, three cents; for points to which it is 55, 60 or 65, four cents. For the next group of three it is five cents. For the next six, and for the $1 rate for 10 words the additional word rate is 7 cents. Knowing this, and that the 10 word rate within the limit of the populous states is 25 cents, and from a state to an adjoining state seldom more than 50 cents, one is in no great danger of being overcharged by an operator or a messenger boy.

Oceanic cable rates have been greatly reduced since the transatlantic cable first became a success, but cabling is still in large part a business necessity or a luxury of grief. Cable rates to London in 1866 were $100 for 20 words. They were reduced in the same year to $50 for 20 words. Next year they became $26.25; in 1868, $16.41; in 1870, $15; in 1871, $10. Then, in 1872, came the word rate of $1. It rose to $1.50 in 1873, and has since been at various times, according to the conditions of competition, $1, 50 cents, 75 cents, and for a while in 1886 12 cents. The present rate of 25 cents was fixed in September, 1888. Cable rates to places on the west coast of Africa run as high as $2.66 per word. The rate to the island of Mauritius, when the Red Sea cable is interrupted and messages cannot be delivered via Aden, is $4.14. The rate to New Caledonia is $2.51, and other Australasian rates vary between $1.27 and $3.23, according to the route employed.

The cable company usually quotes rates to European countries without naming places, unless, perhaps, the capital. Of course, rates may be much higher than the quoted tariff when obscure interior places are to be reached. The telegraph companies join in publishing at Berne a volume that professes to give a list of all the telegraphic stations on earth. The number is between 87,000 and 90,000. Officers of the telegraphic companies hazard the guess that the cable would not be freely used for social purposes, even if the rate to London were as low as 10 cents a word. One reason is that while it is a simple matter to telegraph from New York to a well-known address in London, it is a much more difficult thing to be sure of addresses in provincial towns, and especially in Continental places, where a foreign language comes in to increase the liability of confusion.

The expense of correcting a mistake when telegraphing upon land lines within the territory of a single country is comparatively small, and may be done with reasonable promptness, but when it comes to correcting a blunder in a trifling cable message of purely social significance, the cost is absurdly out of proportion to the importance of the matter involved. So, while some millionaires make a toy of the cable, as of almost everything else, to most persons submarine telegraphy is what Lowell described it after the news of the death of Agassiz came to him at Florence, more than 20 years ago:

> The savage of the skies that men have caught
> And some scant use of language taught,
> Tells only what he must—
> The steel-cold fact in one laconic thrust.



IRONCLAD GENERATORS AND STATIONARY MOTORS.

## Ironclad Generators and Stationary Motors.

The list of slow and moderate speed four-pole dynamos and motors of the General Electric company has been supplemented by a series of machines adapted to smaller output than is practicable with the four-pole type. They are classed under the head I. B., from the fact of having an ironclad bipolar frame, and are built for various outputs—from three-quarters to 4½ kilowatts as generators and from one to five horse power as motors.

The frames are cylindrical and are supported on short legs. This brings the center of gravity very low and conduces to stability and steadiness when running. The space occupied by the machine is small for its output, and its shape and construction allows of its use in positions where machines of the ordinary bipolar type could not well be placed. The armature has a toothed core with the conductors embedded in the slots. Ample cross-section has been allowed the copper in the field and armature windings, and the insulation is of the highest grade. The brush-holders are designed to hold the brushes firmly and evenly upon the commutator, adjusting themselves readily to the wear of commutator and brush, preserving under all conditions a good contact without excessive friction.

The speeds are comparatively low, varying from 1,800 to 1,000 revolutions per minute, according to the size of the machines. They are especially adapted to the requirements of small motor service. Their small size, low speed, high efficiency and simplicity of construction render them peculiarly valuable in printing, wood-turning and establishments of a similar character, and for the operation of small pumps, ventilating fans, machine tools, etc. A large number of these I. B. motors are already in use. The generators are successfully used in insolated plants and in cases where a smal amount of current economically generated is desired.

## Curious Lightning Effects.

French and German electrical papers, more perhaps than those of any other people, have always made a study and recorded the effects of strokes of lightning. More attention elsewhere has of late been given to this subject, and a recent bulletin of the United States Department of Agriculture, by McAdie of the Weather Bureau, contains a large amount of valuable statistical and practical information.

The French journal *L'Eclairage Electrique*, of recent date, chronicles the doings of nature's electricity which have come within the scope of its neighborhood in 1895.

A case is mentioned under date of July last, where several cows in Méobecq, driven by the storm, sought refuge under a tree which was struck by a thunderbolt, and were all killed. One of the animals bore upon her body, where the hair had been taken off, a profile of a person who was present at the accident.

Three children are mentioned, who took similar refuge under a tree which was struck. The children were unharmed, but one of them bore on his body a perfect photograph of the tree, showing twigs and leaves perfectly, which lasted for several hours.

In Liége, on the 10th of June, lightning struck a wall, scattering fragments in every direction, and picked up a part of the wall weighing more than 500 kilogrammes, placing it upon a neighboring wall, to the astonishment of the eye-witnesses.

In Mutfort, Luxembourg, lightning carried off the roof of a house without injuring any of the inmates.

At Cheminas, Ardéche, a person who was struck in the open field, was entirely stripped of his clothing.

At Aincourt, near Nantes, are the remains of an oak measuring once over a meter in diameter, which was quartered by lightning, and even to the deepest roots was badly split up. Beneath these a hole was plowed a meter in diameter. The top was thrown a dozen of meters away, and pieces of the tree were sent flying through the woods 30 or 40 meters; a splinter, 4 5 meters long by 40 centimeters circumference, was stuck in the earth 20 meters away.

At Moulins lightning struck a little, low residence, near a taller one, the latter being unaffected. The family in the affected building—man, wife and four children—was stupefied through fear. The lightning struck the chimney, the bricks of which were scattered. The roof tiles were broken, while in the grain loft an iron rake had the wood handle broken and scorched. The chimney on the first floor was badly shattered, a dozen plates were broken. The wife, who was standing near by, claims that her limbs were "heated by a burning air which escaped from behind the wainscoting, and a thick, poisonous smoke filled the room." Seven panes of glass were broken in one window, while the next window was left intact, and a hole was knocked out of the cellar vault of a dozen centimeters in diameter.

At Pommereuil lightning struck a chimney, followed the ridge of zinc to the point of the roof; thence descending, it splintered the woodwork, scattering it, and in some places charring the wood. It also ran down the masonry and went out the side wall two meters from the ground, through a hole the size of one's little finger. On the wall it left a track under a dress which hung there, turning it red, and tore a piece out as large as one's hand, tore off the plastering for about one square meter, dusted the room and left a smoke smelling of ozone. Some clothes on a chair which it threw over were carried into the kitchen near the chimney, where all traces of the current were lost.

At Obernai an electric spark struck a house, broke up the roof-tiles, broke a pane of glass, tore up the colored paper and the gilding of a picture frame. Then it bolted out of an open window, slid down the balustrade of a stairway, tearing that to pieces, and buried itself under the stable.

At Forest-lez-Bruxelles, in July, a thunderbolt entered a creamery, tipped over the proprietor and his wife, broke a pane in the door, moved a harnessed horse some meters, which stood at the door, entered a neighboring house by the upper route, after having danced along the gutters, finally hitting a dog, which it killed. In another building it completely carbonized several chickens.

A young farmer of Ouzouer-sur-Loire, surprised by a storm, took shelter under a tree, standing with his back against the trunk. A bolt of lightning threw him down, where he lay for some time, bleeding profusely. Help came, and he was in a fair way of recovery when last heard from. His watch stopped, but was not injured so but that it went again when set going. But the crystal was pulverized and the body under the watch had a round superficial burn, and from this to the ground, along the young man's leg, a burned mark like a ribbon showed where the current went to earth.

In Pas-de-Calais a young farm-hand was out driving in a wagon with four horses, when, while adjusting the harness of one of the animals, a descending bolt struck and killed

all four. The youth was not materially injured, except a burning sensation in his legs, which lasted some hours.

## London's Underground Roads.

[From the *Chicago Times-Herald*.]

John Fowler, with a small syndicate as his backers, laid down 43 years ago an underground line of railway from Paddington station of the Great Western railway to a point near King's Cross of the Great Northern, thus joining those two great streams of traffic. It was not, however, until 20 years later that the real basis of the present system was laid down by the Metropolitan Railway company. This was what is now known as the "Inner Circle." Some time afterward the Metropolitan District Railway company was formed, and the scheme then became of a more comprehensive character. Neither of these companies has benefited their shareholders to any appreciable degree. The Metropolitan company commenced paying 5 per cent. dividend, but this dwindled down to 2⅞ in 1889, and has remained about that figure since. The Metropolitan District company never paid anything but a fraction, and since 1883 has paid no dividend whatever. The nominal capital of the Metropolitan is $58,425, the number of miles in work being 38. The gross receipts average $3,000,460, and the net receipts $1,964,000. The working expenses per mile amount to $1,500,000, while the revenue per mile is $91,170. As for the District company, its nominal capital is only $36,570 and its length of way 19 miles. Its gross receipts average $1,985,000, and its net receipts $1,036,000.

The discomforts and dangers of this means of locomotion can never be estimated by anyone who has not made a trip on the underground. At such central stations as Gower street, where the traffic is great and the rails are laid down more than 30 feet below the earth's surface, it is impossible to breathe without ill effects. There is no adequate outlet for the volumes of sulphurous smoke, which pour from the tunnels as the trains pass through; and accordingly the station is filled with noxious fumes. Even in the hottest weather it is better to keep the windows of the railway carriages closed, but when the carriage is crowded, as at certain times of the day it always is, to excess, this is obviously impossible. Leading medical experts have given it as their distinct opinion that the underground railways have been directly the cause of a large number of new diseases. Those who constantly use the 'underground," for so the lines of both companies are familiarly alluded to, develop ailments of the heart or lungs, while the eyes also frequently become seriously affected. To the stranger the effect of a journey on either the Metropolitan or District railway is singularly painful; it produces headache and nausea, and affects the chest and lungs in a marked degree.

To a stranger, the difficulties of travel by the "underground" are almost insuperable. The lines are laid down in circles—thus there are an inner, a middle and an outer circle. The inner circle embraces the city proper, and runs from Aldgate round to Aldgate again. But it is on the outer circle that the uninitiated traveler is most likely to go wrong. He may be within five or 10 minutes' walk of the point he desires to arrive at, and not knowing this, he goes to the Metropolitan or District railway and asks if he can book for such and such a station. The clerk always replies that he can, and the unlucky wight is put on board a train which will carry him around the whole Metropolitan area and take an hour in the doing of it.

## Electric Franchises in Chicago.

At Monday's meeting of the City Council of Chicago the Calumet Electric Railway company was given additional franchises for about 16 miles of street railway in the extreme southern end of the city. The route of the proposed line commences at South Chicago avenue and Eighty-third street, and takes in Lake avenue, Edwards avenue, Seventy-third street, Stony Island avenue, Baltimore avenue, Commercial avenue, Ninety-first street, South Park avenue, Honore street, Seventy-third street, Avenue N, Avenue L, and One Hundred and Eighth street to the Indiana state line. It blankets practically all the Calumet country. The line comes as far north as Sixty-third street and South Park avenue, where it connects with the South Side Alley elevated road. There was a fight on almost every amendment that was offered, and few of them were adopted. Alderman Hepburn got one through providing that if after a period of five years South Park avenue was changed to a boulevard the company should remove its tracks within 60 days.

The American Gas Engine Electric company was given permission to lay and maintain heavy iron or steel three-inch pipes as conduits for electric wires across Clark street, between Randolph and Lake, and across Dearborn, between Randolph and Lake, and after six months is to pay to the city a sum equal to 3 per cent. of its gross receipts. The franchise is for a period of 20 years.

## Electric Drawbridge at Rock Island.

The United States government has an extensive arsenal at Rock Island, in the Mississippi river, opposite Davenport, Iowa. Under its supervision a new drawbridge is in process of erection to replace the old bridge connecting Rock Island and Davenport. This bridge will carry the highway and the tracks of the Chicago, Rock Island and Pacific railroad. The draw span will be 365 feet in length and will be turned by electricity, a 50 horse power motor being used. In the operator's house will be an air compressor driven by an electric motor, furnishing compressed air for operating the pneumatic end jacks and the rail joints at each end of the bridge. Electric track signals at either end of the bridge will also be operated from this house. Each operation required in swinging the bridge—setting signals, opening the rail joints releasing end locks and starting the motor—is controlled from a common stand, the levers of which are interlocking, so that no motion may be made in the wrong sequence. Compressed air was only adopted after the engineers had observed the success with which its use had been attended on the Columbus street bridge at Cleveland, O. G. P. Nichols & Bro. of Chicago have the contract for all the machinery, electrical and mechanical, which is to be used on the bridge.

## Sawyer-Man Lamp Patent Invalid.

The United States Supreme Court on Monday decided the important case of the Consolidated Electric Light company against the McKeesport Light company in favor of the defendant. The court holds the Sawyer-Man patent invalid. The decision was handed down by Justice Brown.

Justice Bradley, in his opinion in the lower court, which this decision affirms, said that Sawyer and Man followed a wrong principle in their work upon the incandescent light—that of small resistance in the conductor and a strong current. The great discovery, he declared, was the adoption of high resistance in the conductor, with a small illuminating surface and a corresponding diminution of the strength of the current. The credit for this discovery he gave to Edison.

Justice Brown read the decision of the court. The court did not enter upon the merits of the claim that this patent was prior to the Edison patent, but contented itself with dealing with the amendments to the patents. Justice Brown said in the course of his opinion that the claims made by Sawyer and Man were too broad, covering, as they did, all fibrous material, unless the same general quality with respect to their character as conductors could be shown.

Instead of this being the case, it had been developed by the experiments made by Mr. Edison on 6,000 articles that there were comparatively few of these materials adapted to this purpose, and it appeared that the Sawyer-Man people had abandoned other materials and adopted the bamboo fiber, which Edison's experiments had proved to be the best for the purpose. If Sawyer and Man had only asked for a patent on the carbonized paper the case would have been different, but, as it was, their claim was not sufficiently specific.

## Electricity at the Paris Exhibition of 1900.

As might be expected, there is much interest manifested in the part that electricity is to play in the Paris exhibition of 1900. This exhibition is to cover a far larger area than its predecessor, for which the 1,716 arc lamps and 12,847 incandescent lamps, which illuminated the grounds and buildings in 1889, will not suffice. About 4,000 horse power was then at the disposal of the management for lighting. Gas is not to be excluded in 1900, but electricity will be the chief source of light, and will probably claim 12,000 horse power. The lighting will not be left to an international syndicate as on previous occasions. Regarding the transmission of power it may be said that the Paris exhibitions mark the ever-increasing demand for machinery in motion. In 1855, 350 horse power proved sufficient, while in 1867, 635 horse power; in 1878, 2,500 horse power; in 1889, 5,500 horse power had to be furnished for motor purposes; and at least 8,000 horse power will be required in 1900. A French journal says that Mr. Picard is perhaps a little optimistic in his estimates, although the exhibitions at Chicago, Antwerp and Lyons support his views. The time has passed when manufacturers deem mere electrical display profitable. It is, on the other hand, manifest that in the case of temporary installations the electrical current affords signal facilities for the transmission of power, and there will be no lack of powerful electric motors if the number of exhibitors comes up to expectations.

## Trolley Extended Farther in Chicago Downtown District.

The Clark street overhead trolley line in Chicago—the road that penetrates the business district, as recently illustrated in the WESTERN ELECTRICIAN—is to be extended three blocks farther north to Washington street. The Common Council authorized the extension on Monday night, but its action created no surprise, as the Chicago City Railway company desired a Washington street terminus from the first, and no doubt was expressed as to its capacity to ultimately secure what it wanted, despite the opposition of the mayor.

The poles, trolley wires and feeders are now in position as far north as Adams street. The trolley wire is exceptionally heavy and of the type used on the Nantasket Beach line.

## Supreme Court to Pass on the Government Suit in Berliner Litigation.

Among Monday's batch of United States Supreme Court decisions was one that gives much comfort to the anti-Bell telephone interests, for it indicates that the government suit to annul the Berliner patent is not to be ended by the adverse decision of the United States Circuit Court of Appeals.

Chief Justice Fuller handed down the court's opinion on the motion of the Bell Telephone company to dismiss the suit of the United States against that company and Emile Berliner, involving the invention of the speaking microphone.

The case was appealed from the decision of the Circuit Court of Appeals for the First Circuit, and the motion to dismiss was based on the ground that the act creating the Circuit Courts of Appeals, in providing that these courts should have final jurisdiction in patent cases, had deprived the Supreme Court of jurisdiction. The motion to dismiss was denied. The opinion is long, concluding as follows:

"We cannot impute to Congress the intention of narrowing the appellate jurisdiction of this court in a suit brought by the United States as a sovereign in respect of alleged miscarriage in the exercise of one of its functions as such, deeply concerning the public interests and not falling within the reason of the limitations of the act."

This, of course, leaves the whole case open, and the government may yet be successful in declaring the patent void. If it is, a wonderful impetus will be given to competing telephone companies.

## Still Fighting the Bell Company in Ohio.

The Central Union telephones have been taken out of all the offices in the court house at Toledo, Ohio, except the auditor's and the sheriff's offices. If officials want telephones in their offices, they will have to pay for them out of their own pockets.

According to the county commissioners, the Central Union company has been charging the county too much for telephones. It was said that there were several hundred subscribers to the Central Union telephones simply because they were in use in the court house, and the company could well afford to give the county a cheaper rate than it had been giving. It was thought the company could afford to donate the use of the telephones. Upon being asked if they would order the company to take the telephones out at that date, the county commissioners said they would simply refuse to pay telephone bills, and if the company wished to leave the telephones there, it could.

L. S. Richardson, on being asked if the company, for which he is attorney, would leave the instruments in the court house, said the company was not in business for its health. "If the commissioners do not want our telephones in the court house, we will go down there and cut the wires and take them out. The company doesn't depend on the court house entirely for its existence."

The feeling against the Bell company is very bitter in Toledo owing to the wretched service given and the high rates charged.

## How to Estimate Trolley Car Speed.

[From the *St. Louis Globe-Democrat*.]

There is in the public mind a confusion of ideas as to the speed of electric street cars. Two inexpert observers guessing at this speed will rarely come within miles of the correct estimate. Yet it is possible for anybody, by a simple calculation, to arrive at very nearly accurate information. An electric car going at the rate of a mile an hour travels 88 feet in a minute. At two miles an hour it makes twice that distance in a minute, or 176 feet. At three miles an hour the distance traveled in a minute is three times 88, or 264 feet. This distance of 264 feet is about the length of an average city block. If it takes a car a minute to go a block the rate of speed is three miles an hour. If the car goes two blocks in a minute the rate is about six miles an hour. Three blocks in a minute means nine miles an hour. Four blocks in a minute indicates a speed of about 12 miles an hour. At five blocks in a minute a car is going 15 miles an hour. When six blocks are traversed in a minute the speed is 18 miles an hour. A rate of seven blocks in a minute is a speed of 21 miles an hour. It must be understood that average blocks are required to make good such estimates.

There is a possibility that the Electric Storage Battery company of Philadelphia will erect a large factory at Niagara Falls, to take advantage of the cheap power. President Gibbs is reported to be in favor of the project.

# CORRESPONDENCE.

## New York Notes.

NEW YORK, November 9.—The North End Street Railway company was incorporated to-day, to construct a street surface railroad 13 miles long in this city. The terminus will be at the intersection of Manhattan avenue and One Hundred and Sixteenth street, and at the intersection of Kingsbridge road and the northerly city line, with branches as follows. Extending from the intersection of Eleventh avenue, or the Boulevard, and Broadway to the intersection of Broadway with Amsterdam, or Tenth avenue; from the intersection of Riverdale avenue and Kingsbridge road to the intersection of Riverdale avenue and the northerly city line; from the intersection of One Hundred and Forty-fifth street and the Boulevard to the intersection of One Hundred and Forty-fifth street and the Harlem river, and from the intersection of Manhattan avenue and St. Nicholas avenue to the intersection of St. Nicholas avenue and One Hundred and Twenty-sixth street. The capital is $5,000,000, and the directors are Edward K. Lynch, William D. Davids and Thomas E. Laughlin of Brooklyn; Daniel H. Shea, Charles H. Sisson, Thomas J. Regan, Frank F. Ogston and William G. Shailer of New York city.

The executive committee of the Brooklyn Bridge trustees, comprising President Howell, Vice-President Page and Trustees Henriques and Keeney, have adopted resolutions that the chief engineer, C. C. Martin, advertise for proposals for switching the cars by electricity, and that bids for heating cars by electricity be also advertised for. The bids are to be submitted by or before noon on Monday. The question of switching cars by electricity was referred at the last meeting of the board to the executive committee. A report is expected from it at the time the bids are opened.

The *Herald* tells of the successful electrical treatment of an unusually rare case of supposed nervous hysteria at Bellevue Hospital Medical college by Dr. Herman W. Biggs, professor of nervous diseases at the college. The patient was a healthy, intelligent woman, 35 years old, who had suddenly become deaf and dumb, as it was believed. There was an effort to speak, but no sound could be uttered. At the same time the patient did not, or professed not to, hear what was addressed to her. Rest and quiet did not bring relief, nor did a calm reasoning, by means of writing, with the woman produce any change such as would be produced by mental treatment in ordinary cases of hysteria. An examination revealed the fact that no local disease interferred; the trachea was in a healthy condition, but the patient had no control of the vocal cords. No vibrations could be produced, and, consequently, no sound was heard. It was clear that the vocal cords were temporarily paralyzed. Professor Biggs told the students that if there was no permanent injury to the cords the local trouble would yield to and be disposed of by the use of electricity. The electric battery was then called into use, the cords were relaxed and the woman spoke as formerly. Hearing and speech were both restored.

The various unions of the Steam Railroad Men's Protective Union in New Jersey have organized a State League in Newark. These officers were elected: President, B. E. Chapin of Newark; vice-presidents, Thomas H. Joiner, Charles H. Houston of Somerville, Joseph S. Galvin of Jersey City and P. J. Dyer of Paterson; secretary, Charles Kendig of Hoboken; treasurer, E. C. Robbins of Millville. Resolutions were adopted pledging the support of the league to organized labor and affirming support for only those representatives for the Legislature who will indorse and support labor measures "not detrimental to the resources of capital." Railroad men in the state are invited to examine the records of legislative candidates and vote accordingly. The extension of the trolley lines in competition with the steam railroads for freight and express matter is announced as unjust and unfair, and the league is pledged to oppose any and all candidates for office who are in favor of "granting any further privileges to the trolley companies than what they at present possess."

W. F. O.

## Buffalo and Niagara Falls.

BUFFALO, November 9.—That the Carborundum company is perfectly satisfied with its course in locating at Niagara Falls is confirmed by the fact that it already intends to move part of its Pittsburg plant to that city. Another large brick building is to be erected by the company for this purpose, and ground has been broken for it just east of the present works. The new building will be 100 by 50 feet, will accommodate the wheel manufacture and small specialties, and will also contain two large kilns for vitrifying purposes, each 22 feet in diameter. The wheels after being pressed are placed in these kilns for a number of days to be vitrified.

The certificate of incorporation of the Buffalo Traction company has been filed in the county clerk's office. This means that Buffalo is to have another street railway. The road is to be 66½ miles long. It is to belt the city from the city line at South Park and from the city ship canal in the Hamburg turnpike to the city line in O'Neill street, across the city to the Pine Hill road in the town of Cheektowaga. It will run on many other streets in the city. The capital of the company is $3,000,000 divided into 30,000 shares, all common stock. The directors are Edwin G. S. Miller of Buffalo, Joseph B. Mayer of Buffalo, Tom L. Johnson of Cleveland, Richard Ladenburg of New York, John K. Page of New York, Louis Kahn of New York, Leonard B. Crocker of Buffalo, Washington Bullard of Buffalo and Herbert P. Bissell of Buffalo. The new road will be one of the finest in the country. It will be operated by electricity, of course. It will be built under the direction of Mr. Johnson. The road will be equipped with heavy rails placed on steel girder ties imbedded in concrete. This will secure the best possible style of road bed. The cars will be of the latest and best pattern. Henry W. Box, attorney for the Buffalo Railway company, said he had not heard of the new company and was not prepared to make comments except in a general way. "In general economics," said he, "competition is a good thing, but it hardly applies in this case. With respect to street railway companies the ends of the public are best served with one road, especially where one company has the start by a number of years. The reason of this rests entirely on the transfer system. We are now carrying 12,000,000 transfers annually. This reduces the cost of fares to about 3¼ cents per passenger. If there are two lines extra fares would have to be paid. Lines would be mixed up, and all this would militate against the welfare of the general public. Much of the territory included in the proposed franchise is already covered by grants to us. The reason we have not built certain lines that perhaps are needed is on account of the extreme opposition. In the matter of a crosstown line such as is proposed, it is absolutely impossible to build such a line, say on Ferry or Utica streets, on account of the violent opposition. Now this new company can't offer any such transportation facilities as we can with our 125 miles. They can't begin to cover the routes we do with our transfer system. I think when the merits of the matter are submitted to the local authorities the taxpayers will see it too."

It is said that the Acetylene Gas company of Philadelphia has concluded arrangements for starting active operations at Niagara Falls. A contract has been closed with the Niagara Falls Power company for 5,000 horse power, which will be used to operate the plant the company will put up. The plans for the necessary buildings have all been prepared, and the contract for their construction has been let. The large generators which will be used have been ordered from the General Electric company, and the officers of the Acetylene Gas company count confidently upon the beginning the manufacture of the carbide not later than January 1st. The present Acetylene company has closed contracts for the manufacture and sale of the gas in the states of New Jersey, Massachusetts, Connecticut, Rhode Island, Ohio, Minnesota, Missouri, Kansas and Illinois, and also in Mexico. The purchasers of the franchises in these states are said to be men familiar with the gas business and capitalists who have had investments in that line.

The large 500 horse power rotary transformer for the Buffalo & Niagara Falls electric road has arrived and is being placed in position in the power house of the Niagara Falls Power company. Power will be furnished to both the Buffalo & Niagara Falls and the local street railroads.

F. C. P.

## Northwestern Notations.

MINNEAPOLIS, November 9.—The council committee on underground wires in Minneapolis turned down a petition to direct the Twin City Rapid Transit company to protect all overhead trolley wires with a certain recently patented appliance, which is to shut off the current and ground it between each trolley pole when there is a break in the wire. General Manager Hield told the committee that the invention was still in the experimental stage and was useless so far as this city is concerned, and remarked that the petition was presented for the purpose of furthering a private enterprise rather than for public good. He also hinted that a certain alderman held a controlling interest in the patent.

H. A. Kinney of Yankton, S. D., has made that city a proposition to furnish electric light for three years, all night, at the same price which is now being paid for half the night service, $170. At the end of the three years the plant becomes the property of the city without further consideration.

The Butte Consolidated Railway company applied to the Butte, Mont., city council for a franchise on certain streets where it desired to build lines, but the mayor took advantage of the request to require it to build a line where it didn't want to, on the penalty of no franchise on any more streets.

H. C. Adams and W. T. Fish have secured a franchise to build an electric line from the end of the street car line in Madison, Wis., to Wingra Park and University Heights. The estimated cost of the line is $15,000 to $20,000.

The Brush Electric company secured the contract to furnish La Crosse, Wis., with 200 or more arc street lights at $85 each per annum for five years.

Alex. Sheridan and Wm. Elford, linemen at La Crosse, Wis., got to quarreling while at work on a pole. They descended to settle their differences, and both were slightly injured in the scuffle. Elford then secured a revolver and aimed at Sheridan's head, but the cartridge did not explode. Sheridan struck him with an iron tool, cutting quite a gash. Elford fired again, the ball passing through Sheridan's knee joint, crippling him for life.

It is reported that the Postal Telegraph company will build into Ashland, Wis., along the line of the new Minneapolis, St. Paul & Ashland railroad.

Some time since Elihu Colman of the Fond du Lac, Wis., Light, Power & Railway company discharged from his employment W. G. De Celle. The latter recently brought suit against Colman to recover possession of the plant, and in his complaint acknowledges a conspiracy on the part of himself to defraud the creditors of the Fond du Lac Light, Power & Railway company, and says that Elihu Colman, acting as his attorney, was a party to the swindle. Prior to the commencement of the suit the dynamos and other property of the company were seized on execution by the General Electric company of Chicago.

The Supreme Court of Iowa has held the Western Union Telegraph company liable for damages in the case of a stock shipper who telegraphed to a point in Dakota requesting the proprietor of a feed stable to have accommodation for a car of horses which would arrive during the night. The shipper reached his destination during a storm, but found no arrangements had been made for his accommodation, and he was obliged to turn the horses into an open lot, where they remained during the night, one of them dying from the effects of the exposure. The telegram sent the night before was delivered at 11 o'clock the following day.

Next spring it is announced that the Selby avenue cable line in St. Paul will be changed to electric power. The hill, which has heretofore been considered too steep for an electric car to surmount, will be overcome by a counter balance, which will support the weight of the car as it ascends or descends the grade. It is understood also that the line will be extended to connect with Minneapolis in a short time.

The school district at Sleepy Eye, Minn., has demanded of the village $4,000 damages on account of the loss of the school house by fire, originating by the explosion of the boiler of the electric light plant, which was located in the basement of the school-house. There will probably be a suit.

The case of the Adams Electric Railway company against the Lindell Railway Company, both of St. Louis, is before the United States Circuit of Appeals in St. Paul. It involves every electric car in the United States, being an action for infringement of patent on a contrivance for mounting an electric motor and all of its parts and intermediate motion for transmitting mechanism, upon a single axle, to be driven by such a motor, so that the axle may dominate all the movements of the mechanism, and leave it undisturbed by the movements of any other part of the vehicle, with a view to preserving the operative relationship of the several parts of the mechanism. The court took the case under advisement.

The village of Blue Earth City, Minn., has purchased the electric light plant, taking effect November 1st, and has ordered new machinery and will make many improvements.

The Menasha, Wis., council has closed a contract with the Neenah and Menasha Gas & Electric Light company to furnish about 60 lights at $78 each per annum. This settles a matter that has been hanging fire for about two years.

The F. H. Kratka Land, Water Power & Improvement company of Thief River Falls, Minn., will be incorporated to build a dam across Red Lake river to furnish power for an electric plant and other enterprises.

The Electric Light & Power company of Berlin, Wis., offers to sell its plant to the city for $20,000, to be paid in ten annual installments, without interest.

After litigation for nearly a year, Grafton, N. D., has bought the electric light plant, and will complete its equipment, putting in arc street lights, etc. The plant has arc light machinery. The price paid is $6,000. Propositions to sell from the company have ranged from $16,000 to the price paid.

The city of Tacoma, Wash., has filed a claim to 400 cubic feet of water in the Puyallup river. The location

is 26 miles from the city, and it is claimed that the water can be brought to the city with a head of 360 feet, and that 5,000 to 8,000 horse power can be developed. The electric light plant and the pumping station will be operated by the power if the scheme is successful.

The council of Mankato, Minn., has ordered the electric light company to shut off the lights, which has been done and the city is dark. The city had plans prepared for a municipal plant, and voted bonds for $10,000. On opening the bids they were found to be $4,000 above the bonds. While the council was pondering on what to do in the matter, the firm that purchased the bonds rejected them as being illegal.

The Sac City Electric company of Sac City, Iowa, has incorporated with $15,000 capital stock.

There is talk of an electric railway between Mankato, Minn., and St. Peter, Minn.

The boiler of the city electric light plant at Chariton, Iowa, gave way some weeks ago, compelling the plant to shut down. The leak was repaired but soon began to leak again, again compelling a shut-down. The city is financially unable to put in new boilers and the old ones cannot be repaired, so it is suggested to lease the plant to a private firm.

The street car system of Moline, Ill., was "manned" by woman conductors one day recently, the proceeds going to a hospital association. M.

## PERSONAL.

Henry Abbott of New York, president of the Calculagraph company, was in Chicago several days last week.

O. P. Sells of New Orleans, one of the leading electrical engineers of the Crescent City, is stopping in Chicago for a few days.

George G. Carter, who has many warm friends in Chicago, has attained considerable prominence in Mexico, where he has been engaged during the last two years in developing coffee lands. A recent number of the *Mexican Herald* contains a flattering notice of the enterprise with which Mr. Carter is connected, the Metaltoyuca Colonization company. This concern has already secured 100 American families among the purchasers of its lands, and quite a prosperous settlement has been established. Mr. Carter is president of the company, and, no doubt, the life of the enterprise.

Julius Runge has succeeded Colonel William H. Sinclair as president of the Galveston, Tex., City Railway company. The latter gentleman has disposed of his interest in the road and retired from the management. A local paper, speaking of Colonel Sinclair's connection with the city's street railway business, said: "He has been president of the Galveston City railway company continuously for 16 years and knows every rail and tie in the 40 miles which have been laid under his supervision. He has been up early and late looking after the road. Whenever a new line has been started, whenever an accident to the equipment has occurred, the colonel has always been found riding on the front platform. He has given a greater amount of personal time and attention to the line than is usually to be found in managers. He liked his labor."

## ELECTRIC LIGHTING.

The Electric Light & Power company of Canton, O., has increased its capital stock from $50,000 to $150,000, and will hereafter be known as the Canton Electric, Heat & Power company. The company proposes to take up the heating business, and the capital stock was increased with that object in view. When the company has perfected all its arrangements the heating department will comprise both steam and electricity.

The Beatrice, Neb., Rapid Transit & Power company and the Beatrice Light & Power company have been consolidated by the formation of a new company to be known as the Beatrice Electric company, with a paid up non-assessable capital stock of $1,000,000, the incorporators being John A. Horbach, Paul W. Horbach and Victor G. Lantry of Omaha, and John E. Smith and A. S. Maxwell of Beatrice. The officers elected are: President, John A. Horbach; vice-president, John E. Smith; secretary, A. S. Maxwell; treasurer, Paul W. Horbach. Extensions will be made.

Regarding the attempt to illuminate the dials of St. Paul's Cathedral clock, London, Messrs. Kendal & Dent write to the *City Press* suggesting several devices for accomplishing this. One of the courses they suggest is the removal of the central glazing, reverting to the original dials, and placing a ring of electric lamps around each dial, one lamp at, say, each of the hour numerals. They suggest, as an alternative, the illumination of the hands, or the tips of them. "This would be quite practicable by means of incandescent electric lamps, although some of the details might be a little troublesome to work out."

## ELECTRIC RAILWAYS.

The Seattle Consolidated Street Railway company will build a new power house. It will be on the site of the old power house that was burned a few months ago, at Fifth and Pine streets, and will be of brick and practically fireproof. The main building will be 60 feet wide by 256 long, and adjoining this will be a shop 30 by 150 feet. The company expects to expend about $100,000 in the construction of its new power house, the purchase of new equipment and new rails, which are already on the way.

Another step in the consolidation of all the street railway systems of Kansas City and tributary territory was taken at Independence, Mo., when Colonel C. F. Morse, president of the Metropolitan Street Railway company, bought the Kansas City & Independence electric line for $600,000. The proceeding, although little more than a formal one, was of much interest. Eighteen months ago, when the Grand avenue and Ninth street cable systems were consolidated, the new company a day or two later absorbed the Kansas City & Independence railway running past Washington Park. The road was then operated by steam power, but has since been converted into an electric road. It is a very valuable suburban line, and a feeder for the Ninth, Twelfth and Fifteenth street cable roads, all of which are now under one management.

## MISCELLANEOUS.

A record was established at Deptford by the 1,000 unit machine recently erected by Messrs. Ferranti, when it delivered current at 12,500 volts. This is, to our knowledge, says the London *Electrical Review*, the highest electromotive force ever developed by a machine. The machine was put on the ordinary lighting circuit for six hours, the running being remarkably steady.

Attention is attracted to the heating plant which is being installed in the Carmelite Monastery at Niagara Falls, Ont., inasmuch as electricity will be used for the purpose. It is not intended that the entire institution shall be heated by electricity, but as a fixed amount of electric power has been arranged for by the institution the surplus will be used for heating a portion of the building. Electricity will be used entirely for cooking and for all power purposes, and also for laundry work. The system has been designed and will be installed under the supervision of W. S. Hadaway, Jr., of the Central Electric Heating company of New York. The cost of heating buildings by electricity has not yet reached figures which will make it an everyday competitor in the heating world, consequently the operation of the heating system in this monastery will be closely watched by all who are interested in the electrical field.

*Stahl und Eisen* describes a method of annealing wire by electricity devised by Lagrange & Hoho for the works of H. A. & W. Dressler, at Creuzthal, in Westphalia. The apparatus consists of an electrolyzing tank containing a werk solution of salt in water, with a surface covering of petroleum. A plate of lead near the bottom of the tank, connected with the positive pole, forms the cathode, while the wire is guided through the tank parallel to the cathode by two insulated rollers immersed at about half the depth of the fluid. As it passes downward it receives the current from the negative pole by a roller contact similar to that of an overhead electric railway, and sets up decomposition in water, with an accumulation of hydrogen around it. This causes it to become red hot from the increased resistance to the current; it is softened without becoming oxidized, as on passing the second roller it is cooled by the upper part of the bath and protecting cover of petroleum on the top. The tension of current is about 200 volts, and the operations of pickling and mashing are not necessary,

## TRADE NEWS.

Manager C. D. Crandall of the Western Electric company is making an extensive tour through the far West.

The Solar Electric company of New York has recently been reorganized and arrangements made to increase its capacity to a large extent in the near future. This concern has been doing a large business in arc lamps, switches and switchboards. A very handsome switchboard has recently been completed for the Vanderbilt mansion at Beltmore, N. C. The company also shipped a switchboard of special design for the public printing office of Washington, D. C. The high standard of the products turned out by the Solar Electric company is well known, and its business will doubtless continue to increase.

A movement is on foot to reorganize the defunct Detroit Electrical Works and put the plant upon a firm footing. The scheme is in the hands of James I. Ayer of New York, Cameron Currie and Thomas Jerome of Detroit. Mr. Ayer is consulting with the New York creditors. It is proposed, if possible, to buy the works at the price which they would bring at a forced sale, which would be, it is estimated, about $50,000. The idea which has been advanced is to raise $50,000 to buy the works, and then to raise about $100,000 to be used as operating capital. The works are said to be worth about $200,000. The concern has been running in a small way during the last two years, but if the reorganization can be effected it is expected that employment will be given to about 275 men.

The electrical trade will be interested to know that the Electric Appliance company of Chicago has just issued the first number of a monthly trade house organ intended for gratuitous distribution. It is entitled *The Electrical Trade* and states that it proposes to furnish each month a revised list of the company's electrical supplies, its lines of bargain-counter articles and display announcements of the goods it sells or is agent for, served up with bits of electrical history, extracts reprinted from the leading electrical journals and other matter, thus combining in a single compilation the numerous trade circulars the concern has been in the habit of issuing. It is a neat production, as might be expected when arranged under the direct supervision of Secretary Thomas I. Stacey, whose original and catchy advertisements are known everywhere.

A fire occurred at the Glassboro, N. J., manufacturing plant of the Whitney Glass Works on the morning of October 26th, damaging one of the four furnaces located there and destroying a portion of the stock of raw material and manufactured goods, and a portion of the moulds and appliances. On the same day, and before the ruins were cold, the company had started rebuilding, and on October 29th began making glass in the damaged factory. Reconstruction of the destroyed property is being pushed as rapidly as possible, and beyond the few days interruption already caused, customers can depend upon prompt service and attention to their wants. This is the first fire of any importance the Whitney factories or warehouses have sustained in the 120 years of operation, and it caused but three days interruption in manufacturing, and that in only one factory.

The Peerless Rubber Manufacturing company of New York has opened offices at 970 Old Colony building, Chicago, in charge of the general sales agent, H. W. d'Evers. The company will carry in its warehouse in Chicago a full line of air brake, steam and water hose, rainbow packing, gaskets, and all mechanical rubber goods used by railroads, large manufacturing concerns and electric light and power stations. The company has just increased its capital stock from $75,000 to $300,000, all of which has been taken by the former stockholders. Under the management of President C. H. Dale the business of this company has grown from $40,000 in 1889 to over $750,000 the present year. A small plant for the manufacture of electrical supplies is also now being established in a western city. In addition to this the home plant of the company at New Durham, New Jersey, is being enlarged to keep up with the growing business. There are 235 men employed, and the buildings consist of a mill two stories high and 325 feet by 60 for making hose, a moulding room 125 by 40 feet, two stories high. Another mill and grinding house is 125 by 40 feet; this is known as No. 1. Then there is No. 2 mill, 85 by 30 feet, a callender and packing building, 110 by 40 feet, a spreading and coating mill two stories high and 125 by 60 feet, also a number of necessary small outbuildings and storehouses of various kinds. Although crude rubber is rapidly advancing in price, the Peerless company is guaranteeing prices to regular customers. The company has a good and efficient plant and can turn out promptly any desired amount of rubber goods.

## BUSINESS.

The Electric Storage Battery company has closed, through Zimdars & Hunt, a contract for a storage battery of chloride accumulators for the yacht Intrepid, auxiliary of the New York Yacht club.

The Electric Appliance company, Chicago, is receiving some flattering testimonials on the Packard Mogul lamp, which is certainly growing in favor rapidly for lighting large interiors. A record of several thousand hours' life on these lamps is becoming quite an ordinary occurrence.

H. L. Merritt, who for the last eight years has been identified with some of the principal lamp factories in the United States, has become proprietor of the Boston Incandescent Lamp company. He will continue to furnish the well-known "Boston" lamp at the old stand, 70 Pearl street, Boston.

W. D. Forbes & Co., engineers and manufacturers, of 1300 Hudson street, Hoboken, N. J., send out a tastefully printed catalogue of their steam engines, milling machines, hydraulic hand pumps and fine machine work. They do designing and draughting for inventors and others and guarantee first-class workmanship.

A. Grothwell, 314 Montgomery street, San Francisco, Cal., is supplying the Ferre electric paint, for which many strong claims are made. It is used extensively by the electrical fraternity in the West, and is said to be water-proof, odorless, preservative and acid proof. Mr. Grothwell has thus far met with gratifying success in the sale of this insulating material. He will cheerfully furnish further information upon request.

The business of the Sprague Electric Elevator company of New York is rapidly growing. This has been brought about by the practical success of its installations in the larger cities of the country. Among the recent contracts which have been awarded to this concern are the following: Manhattan Hotel, New York, eight elevators; Canada Life Insurance company's building, Montreal, two elevators; Mabley building, Detroit, Mich., 10 elevators; Commercial Cable building, New York, six elevators; the Young Men's Christian association building, New York, three elevators.

Certain improvements on the Webster vacuum system of steam heating are described in a small pamphlet just issued by Warren Webster & Co of Camden, N. J. These improvements are designed primarily to produce a more perfect circulation of steam in the heaters employed of any type; to render the apparatus self-controlling; to cheapen the cost of construction by enabling smaller mains and returns to be used and to prevent waste of steam or water. Warren Webster & Co. are specialists in examining steam plants, and have made installations in 53 buildings in the United States since January 24th last.

Williard P. Jones visited Chicago last week in the interest of the Law Battery company of New York. Mr. Jones is making an extensive trip through the United States, having left New York some weeks ago and reached Chicago Monday of last week. Mr. Jones will continue farther West, returning through the southern states. He reports business as being excellent, and announces that the Law cell is finding new friends every day. It may be said to the credit of Mr. Jones that he is an experienced battery man and his energetic efforts in continually pushing the Law battery are bringing in good results to his company.

The Stewart Electric Repair company, located at the southeast corner of Fifth and Sycamore streets, Cincinnati, Ohio, having the shops formerly occupied by the Electric Supply & Contracting company, whose machinery, tools, patterns, etc., have been purchased, is prepared to meet emergency calls, carrying in stock extra armatures of standard make, which will be loaned to those needing such assistance. The company will undertake the repairs of any and all electric machinery and is willing to make yearly contracts with those owning central stations, or others, to keep their apparatus in perfect condition for a stipulated price.

At a recent exhibition in Philadelphia of the Hatch storage battery the cells were continuously operated for four hours, lighting a group of fifty 16 and 32 candle power lamps and driving a motor. George E. Hatch of Quincy, Mass., is the inventor of this cell. Instead of the lead grid, which constitutes one-half the weight of a storage battery, Mr. Hatch uses light porous earthenware plates and places the active material upon them instead of in them, and by closing them together and binding them in place with light wooden boards and flexible rubber bands, he secures strength, lightness and elasticity to allow for expansion and contraction. The material used is the same as that employed in all storage batteries, peroxide of lead and a 20 per cent. solution of sulphuric acid. The current is conveyed by means of thin lead sheets inserted between the plates filled with the active material. The cheaper, lighter and more lasting the battery, the better it is. The Hatch battery is said to possess these advantages. The construction makes a solid integral in all its parts, and entirely unaffected by the jolting or concussions of railway carriage service.

A change of considerable interest to the shoe manufacturing trade is being made by the General Electric company for a factory in Ohio, which is engaged in equipping its works throughout with electricity for the operation of its machinery. For this purpose a 75 horse power multipolar moderate speed generator driven by a belt from a steam engine has been installed and a further provision made for a generator of about 100 horse power for direct connection to an automatic engine. The current from the generators is supplied to the following motors: Two of three horse power capacity, slow speed type, geared direct to the shaft of the fitting room; one of 15 horse power belted directly to the line shaft in the bottoming department: one of 20 horse power coupled directly to the dust collector. A further installation of motors will be made a little later on in the fitting room and also in the bottoming department. Still another motor will run an additional dust collector, and two belted motors will run elevators. The first motors were started a few days ago and the operation of the machinery so far seems perfect. This is the first step toward the adoption of electricity in shoe manufactories in that section, and it is anticipated that the economy and convenience shown in this plant will lead toits more extensive use in the operation of many old and certainly all new shoe factories.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued November 5, 1895.*

549,094. Brake for Electric or Other Cars. Edward S. Amrock, Boston, Mass. Application filed March 16, 1892.

In a car operated by an electric motor there is a hydrostatic bellows having heads of different areas, the large head being connected to the brake beam and the small head to a rod having a furcated end in which a rack bar is free to slide, the bar being connected to the operating lever and the rack in gear with a pinion on a shaft carrying a sprocket wheel for operating the chain of the electric switch.

549,132. Electric Arc Lamp. Francis Jehl, Vienna, Austria-Hungary. Application filed May 12, 1894.

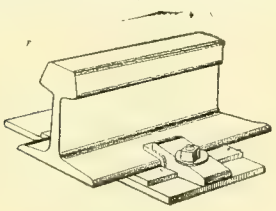
A quiescent or stagnant gaseous envelope surrounds and extends along the carbon to the point or face from which the arc emanates.

549,136. Street Car Lighting. Frank E. Kinsman, Plainfield, N. J. Application filed February 27, 1895.

In connection with the branch from the main line, exterior to the car, containing the lamps in series, there are a branch in parallel containing a storage battery and a resistance, supplemental lamps in an open circuit from the battery, and means operable by a failure of current in the main line branch to close the circuit of the supplemental lamps.

549,152. Electric Heater for Curling Irons. George D. Pogue, Jerseyville, Ill. Application filed March 29, 1895.

The device comprises a heating coil, a hollow metallic core on which the coil is wound, one end of the latter being electrically connected with the core, so that the latter will form one of the terminals, a support for the article to be heated, so secured in position with relation to the coil, and so connected with the opposite line wire as to form the opposite terminal, so that the implement to be heated will, by resting upon the support and the interior of the core of the coil, close the circuit.



NO. 549,416.

549,153. Controlling Electric Motors. William B. Potter, Schenectady, N. Y. Application filed August 18, 1895.

The three-wire system is employed, permitting the connection of two motors between an outside main and the neutral, and then connecting them between the two outside mains, preserving the connection to the neutral between the two motors.

549,162. Electric Switch. Joseph B. Smith and Albert L. Clough, Manchester, N. H. Application filed April 26, 1895.

Springs are employed tending to hold the switch in an open position, an electro-magnetic mechanism consisting of two electro-magnets having their windings respectively in series with the armature and field of an electric motor, the electro-magnets acting in mechanical opposition upon a pivoted armature, and one or both of them having a movable pole-piece capable of adjustment in such a manner as to vary the distance between the cores of the magnets and their armature, the armature being adapted for engagement with the long arm of a pivoted angular lever, the lever carrying on its short arm a catch capable of engagement with a detent fastened to the switch, and when so engaged acting to hold the switch closed.

549,179. Printing Telegraph System. Jonathan E. Woodbridge, Duluth, Minn. Application filed January 29, 1895.

A shaft and means for rotating it are provided, together with a series of interlocking and independently movable stops, having each three functional positions, and electro-magnetic mechanism, whereby the stops are independently controlled.

549,186. Electrolytic Apparatus. Thomas Craney, Bay City, Mich. Application filed March 16, 1893.

An inner metallic vessel is suspended free from the sides and bottom of the outer vessel, and has a perforated base constituting a cathode. There are also an insulated lining section for the side walls of the inner vessel, a diaphragm on the perforated bottom, and an anode resting on and forming a covering for the diaphragm.

549,189. System of Electrical Distribution. William M. Fairfax, Brooklyn, N. Y. Application filed February 7, 1893.

The method consists in supplying current to a number of groups of devices in succession, and maintaining the potential constant in each group by generating a counter-electromotive force in derivation to each group, and varying the counter-electromotive force by the varying current in the respective group.

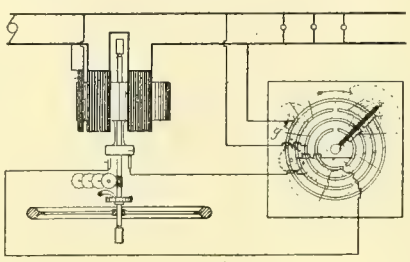
549,195. Electric Meter. Ralph O. Hood, Danvers, Mass. Application filed March 9, 1895.

The motor has fixed coils in series with the main circuit, and movable armature coils in a shunt circuit. Means are provided for stopping the movement of the armature at regular intervals of time, and a mechanism for recording the movement of the armature.

549,201. Incandescent Lamp Reflector. Charles J. Klein, New York, N. Y. Application filed April 18, 1895.

A shade or reflector is described, having near one end an engaging means for the neck of the lamp, and near the other end a perforated spring for receiving the end point of the lamp, the spring being curved inwardly toward the center of the reflector, and the edge of the reflector extending beyond the spring, whereby the entire illuminating power of the lamp is made available for concentration upon a particular spot by the reflector.

549,209. Electro-magnetic Switch. Charles L. Penny, Newark, Del. Application filed March 12, 1895.



NO. 549,195.

The electro-magnet has two independent coils, one coil having more magnetic force than the other, and an armature for the magnet, in combination with a main circuit which includes the coil of the electro-magnet having the lesser magnetic force, the main circuit being opened and closed by the movement of the armature, and a governing circuit which includes the coil of the electro-magnet having the greater magnetic force.

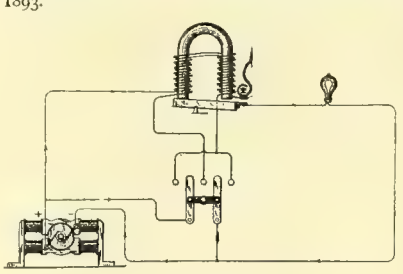
549,234. Armature for Dynamo-electric Machines or Motors. Ward Decker, Owego, N. Y. Application filed November 17, 1892.

Where a four-pole machine is desired, or one whose number of poles is divisible by four, the armature winding is composed of two groups of coils, the coils in one group differing in length from the coils in the other group, and connected electrically in sets composed of a number of short coils, all electrically connected together, and connected in series with an equal number of long coils, all connected together.

549,237. Electric Switch. Gerald W. Hart, Hartford, Conn. Application filed March 19, 1895.

An operating handle spindle is supported by the base, with a cover loosely placed over the face of the switch. There is an elastic connection between the operating handle spindle and the cover, the elastic connection thrusting the cover with a yielding pressure toward the base and away from the handle.

549,240. Electrical Annunciator. Robert L. Hunter, Minneapolis, Minn. Application filed December 11, 1893.



NO. 549,209.

In an electrical indicator the combination is claimed of the main line, a plurality of normally open branch lines in multiple therewith, circuit closers in the branch lines, means for automatically breaking connection between the circuit and its branches, a recording device, and a motor-driven shaft in mechanical connection with the pointer of the indicator, and actuating the recording device.

549,241. Electrical Annunciator. Robert L. Hunter, Minneapolis, Minn. Application filed February 3, 1894.

Indicators are operated conjointly and simultaneously by any one of several circuit closers, and the common recording mechanism is operated by the breaking of the indicator circuit when all of the indicators have made their indications.

549,254. Method of Making Insulator Rings. Charles F. Peterson, Schenectady, N. Y. Application filed June 1, 1895.

The method of forming flanged insulator rings of built-up pieces of mica consists in bending pieces of mica, assembling them to form a predetermined shape, cementing them together as the irregular structure is built up, subjecting the structure to pressure and heat, and chilling the same.

549,268. Arc Cut-out. Caryl D. Haskins, Newton, Mass. Application filed March 6, 1895.

Terminals are combined with a spring-actuated toggle-lever, the springs and lever arms of which form a part of the main circuit.

549,304. Telephone. Samuel Alexander, Hartford, Conn. Application filed September 24, 1895.

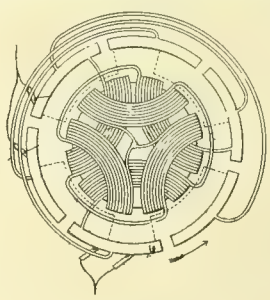
There are combined in this instrument the sounding case, the sounder, the hollow sound conducting post, the transmitter case pivotally attached to the post, and the curved tube rigidly attached to the transmitter case and telescopically attached to the post.

549,346. Transmitting Time Signals. Charles E. Buell, North Plainfield, N. J. Application filed May 27, 1895.

A series of metallic circuits radiates from a central station having an annunciator in each circuit, secondary clock mechanism adapted to become automatically electrically connected to and disconnected from the circuits at predetermined intervals, and a time transmitting apparatus having connections to the several circuits to temporarily exclude the annunciator in each from magnetizing currents, and connections to a regulated current of electricity for each circuit during the transmission of the time signals.

549,383. Automatic Regulator for Converters of Energy. William E. Moore, Augusta, Ga. Application filed March 20, 1895.

This is a speed regulating device, including a motor and an adjustable power cut-off connected thereto, a speed indicator operated by the motor, a source of electricity, electric circuits controlled by the speed indicator, and mechanism operated by the electric circuits for moving the cut-off in either direction to a point proportional to the number of the circuits energized by the speed indicator.



NO. 549,234.

549,409. Electric Arc Lamp. Charles F. Vogelius, Bloomfield, N. J. Application filed January 17, 1895.

There are a vertically sliding yoke and ring connected with the bottom of the globe, the members of the yoke having the right and left threaded screw connection with the ring connected to the bottom of the globe.

549,416. Insulating Rails. Francis W. Wilson, New York, N. Y. Application filed June 22, 1895.

The cut shows the insulating base plate, having openings at opposite sides, the clips extending over the base flange of the rail, and also having an integral portion extending downward into the openings of the base plate, insulating side pieces interposed between the clips and the upper surface of the rail base, and fastening devices for the clips.

549,456. Carbon Contact Resistance Switch. Friedrick G. H. Meyer, Charlottenburg, Germany. Application filed April 4, 1894.

The claim is for the combination with a vertical rocking lever carrying two horizontal arms, of a slide adapted to be engaged by the horizontal arms, movable refractory contacts carried upon the slide, and stationary refractory contacts adapted to be successively engaged by the movable contacts.

549,464. Electrical Dental Engine. Frank C. Priestly, Denver, Colo. Application filed February 12, 1895.

Included in the arrangment is the motor, the plugger comprising a reciprocating bar, a spring for imparting motion to the bar in one direction, a solenoid for imparting motion to the bar in the opposite direction and lying in the motor circuit, and means for alternately making and breaking the solenoid circuit at the motor as the armature rotates.

549,470. Electrical Resistance. Henry E. Werline, Lancaster, Pa. Application filed December 23, 1895.

Lapping filaments are connected to form a continuous conductor, the electrical resistance of a portion of the conductor varying in a direction opposite to that of another portion thereof under changes of temperature. Non-conducting walls are interposed between the lapping filaments.

549,477. Local Transmitter Circuit for Telephones. William W. Dean, St. Louis, Mo. Application filed March 29, 1895.

A local transmitter circuit is designed, comprising two parallel branches, two induction coils having their primaries included one in each of the branches of the transmitter circuit and their secondaries in the telephone line, a microphone included in each of the branches of the transmitter circuit, and means for simultaneously increasing the resistance through one of the microphones as the resistance through the other microphone is decreased, and a source of current connected with the telephone line adapted to direct current through the branches in parallel.

Western Electrician.

EVERY SATURDAY.

Vol. XVII. CHICAGO, NOVEMBER 23, 1895. No. 21

## West Side Park Lighting System.

Work is about to be begun on what will be one of the largest arc lighting plants in Chicago. This is the system planned for the West Side Board of Park Commissioners by Forée Bain which will illuminate Humboldt, Garfield and Douglas parks and the connecting boulevards. The plant will have a capacity of 700 all-night arc lamps of 2,000 candle power and will cost, exclusive of land, about $200,000. It is of interest to the electrical man from its size and from the arrangement of the dynamos in the power plant in an entresol or half-story in the engine

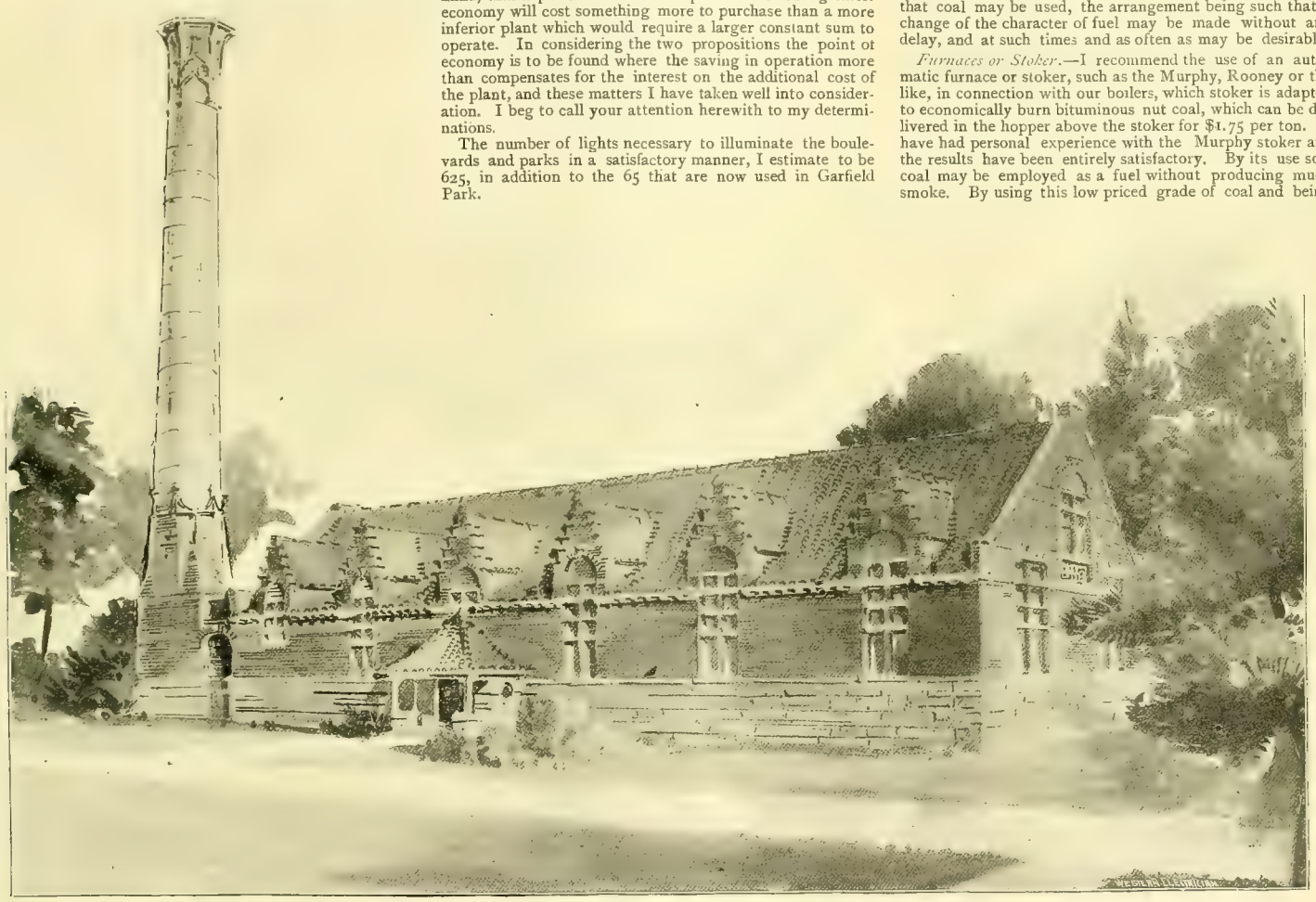


FIG. 1. WEST SIDE PARK LIGHTING SYSTEM.—EXTERIOR OF POWER HOUSE, GARFIELD PARK.

room, but principally from the fact that the conditions are almost ideal for economical operation, as the entire load will be constant every night through 10 hours of service. It is estimated that the cost of operation per lamp hour will be 1.14 cents or $3.42 per month. These figures, however, are estimated on the basis of non-political operation and do not include interest on the cost of the land and building, water or taxes, as the plant is on public property. They are not to be compared with the corresponding expense in commercial plants, as the conditions are widely different.

The power house, of which J. L. Silsbee is the architect, is shown in perspective in Fig. 1 and in plan and section in Figs. 2 and 3. It will be placed in the northwestern tract of Garfield Park, near the park barns at Kinzie street. Some of the circuits leading from it will be seven and eight miles long. The building will be of brick, 150 feet long and 60 feet wide, with walls 25 feet high and an iron trussed roof covered with tiling. It will be divided into a boiler room and an engine room, as shown in Fig. 2, with a fireproof wall between. A longitudinal section, showing the dynamo entresol in the engine room, is given in Fig. 3. The stack will be of steel, lined with fire brick, and 150 feet high. It is proposed to burn coal screenings as fuel, and undoubtedly an automatic coal-carrying and ash-delivering device will be installed. It is expected that the plant will be in operation by the 1st of next July.

The best description of the plant is that made in the carefully prepared report of Mr. Bain to the commissioners, which, slightly abridged, is as follows:

In submitting this estimate I have had in view as the most essential factor the feature of economical maintenance and operation. It is a fact, as it will naturally appear to your mind, that a plant which can be operated with the greatest economy will cost something more to purchase than a more inferior plant which would require a larger constant sum to operate. In considering the two propositions the point of economy is to be found where the saving in operation more than compensates for the interest on the additional cost of the plant, and these matters I have taken well into consideration. I beg to call your attention herewith to my determinations.

The number of lights necessary to illuminate the boulevards and parks in a satisfactory manner, I estimate to be 625, in addition to the 65 that are now used in Garfield Park.

[Mr. Bain here presented detailed specifications of the distribution of lamps.]

Adding 10 per cent. to the length of wire for the branches going into the poles, there will be required 300,000 feet of wire and an equal amount of conduit.

The lamps will be placed 200 feet apart on each side of the boulevards, so that the lights on one side will be intermediate between the lights on the other side of the grass plot, by which arrangement there will be one lamp every 100 lineal feet of the boulevard, except in some cases where this arrangement may be altered to meet the varying conditions.

I herewith attach a drawing [Fig. 5] showing the location of the lamps along a portion of the boulevards and the distribution of lights. The circles around the lamps show the area of the most intense rays of light; it will be noticed that these circles cross each other only over the driveways, giving the most light where it is required.

I have drawn an outline [Fig. 2] of the building required for the power plant. [The architect's perspective view is reproduced in Fig. 1].

The floor space required for the building is 60 by 150 feet Within this building there can be placed boilers of 1,000 horse power, engines of 1,000 horse power and dynamos sufficient for 1,500 lights. It is designed to occupy only one-half the space for the present installment.

*Steam Boilers.*—I suggest the use of water-tube boilers adapted to carry a pressure of 125 pounds of steam. These boilers are somewhat more expensive as to first cost, but they are more durable at that pressure and somewhat more economical and are much easier repaired. In order to realize the highest economy it is desirable to carry not less than 125 pounds of steam, and this is somewhat beyond the practical capacity of the ordinary tubular boiler. I find that the water-tube boiler people are quite willing to guarantee an evaporation of 10 pounds of water to one pound of coal, whereas the tubular boiler seldom exceeds an evaporation of 7½ to eight pounds of water to one pound of coal, and the tubular boiler is not practical at the pressure it is desired to carry.

*Fuel.*—I have taken the matter of fuel into careful consideration and I believe that it is desirable to arrange the boilers so that oil may be used, and to so arrange them that coal may be used, the arrangement being such that a change of the character of fuel may be made without any delay, and at such times and as often as may be desirable.

*Furnaces or Stoker.*—I recommend the use of an automatic furnace or stoker, such as the Murphy, Rooney or the like, in connection with our boilers, which stoker is adapted to economically burn bituminous nut coal, which can be delivered in the hopper above the stoker for $1.75 per ton. I have had personal experience with the Murphy stoker and the results have been entirely satisfactory. By its use soft coal may be employed as a fuel without producing much smoke. By using this low priced grade of coal and being able to evaporate even eight pounds of water per one pound of coal, we will produce our power much more cheaply than where oil or hard coal is used. In this connection I will say that the Murphy people offer to guarantee that they will evaporate as much water per pound of coal (i. e., 10 pounds) costing $1.35 to $1.50 per ton, with their furnace, as an equal amount of hard coal will evaporate. By the use of the automatic stoker one fireman will be sufficient to take care of a boiler having 1,000 horse power capacity.

I would suggest that the storage bin be constructed convenient to the plant, so that the coal may be easily unloaded from the car into the bin, and from there conveyed by the proper conveyors into the hopper above the furnace.

*Engine.*—The engine which I have considered best adapted to our use will be a first-class compound condensing Corliss engine with the high and low-pressure cylinders independently connected to the shaft, the connection of the two cylinders being each made to a separate crank, which should be placed at right angles to each other. By this arrangement four impulses are given to the shaft at each revolution instead of two impulses, as would be the case if the cranks were placed opposite or in the same plane, giving steadier and more even power. This arrangement of engines admits of the independent use of either cylinder, so that in case of damage or accident to either cylinder, or any of its operating parts, the damaged side may be disconnected and the plant operated by a single cylinder. For instance, if the low-pressure cylinder should be damaged and require

repair it may be disconnected and the pressure of the boiler may be raised 20 per cent. and by the use of the condenser on the high-pressure cylinder the engine will be able to carry the load. In the event that the high-pressure cylinder should require repair it may be disconnected and the plant operated by the use of the low-pressure cylinder, which will be so arranged that the live steam from the boiler may be used direct in this cylinder. Of course you will understand that under disabled conditions the engine will not operate as efficiently as it would under its most favorable conditions, but it is also a fact that the possibility of damage to the engine is very remote. There are a number of firms who are manufacturing engines of this character and who will be quite willing to arrange their engine so that it may be used in the manner I have described.

I have contemplated the use of two separate and distinct engines of this character when the plant shall be entirely completed, having in view the idea of using only one engine in the immediate installation. I have designed the building so it will be sufficiently large to contain two engines of this type and size.

As the engines will be compound condensing they will require considerable water, and to this end I have contemplated the use of the water in the small lakes, and by using a circulating pump the water may be forced through a surface condenser and returned to the lakes without injuring the water in any way or changing its condition, or materially altering the quantity in the lakes, and the heat will not disturb the ordinary temperature of the lakes. The surface condenser will not contaminate the water with oil, as would be the case if the jet condensers were used. The condensed water from the surface condenser, which is heated to a high degree, may be passed through a mechanical cleaner and returned to the boiler at a high temperature, thus utilizing the heat contained in the water to increase the economy of the plant. Every 10 degrees used in this way will operate to save one per cent. of the coal required. In using the condensed steam, by returning it to the boilers, we will require only about 10 per cent. constant supply of water that we would otherwise; besides, by having distilled water in the boilers, deterioration is greatly arrested and its steaming qualities are not so greatly curtailed. I predict that we will be able to produce our power for 1½ pounds of coal per horse power.

*Jack-shaft, Clutches, etc.*—The engines are to be situated at opposite ends of the room and each engine to be connected by means of a rope drive to a jack-shaft six inches in diameter, and designed to be revolved at a speed of approximately 250 revolutions per minute. The jack-shaft will be located on the same floor with the engines and will be about 50 feet long. The engine will be connected to the jack-shaft through the rope drive on to a pulley made fast to a short section of the shaft with the bearings on either side. This short section of shaft will be connected to the main jack-shaft by means of a three-part positive drive clutch. The shaft will be provided with automatic oiling and self-adjusting bearings. There will be a friction clutch for each dynamo used. This friction clutch will be so arranged that it may be started and stopped by means of a pulley or brake wheel located near the dynamo.

*Dynamo Room.*—The dynamo room I have designed to be situated in an entresol immediately above the jack-shaft and a portion of the engine. [This arrangement is shown in Fig. 3.] The floor of the dynamo room will cover one-half of the space of the engine room, and it will be located 15 feet above the engine room. The dynamo floor is to be built on the mill construction plan. It is to be composed of heavy, dressed lumber, thoroughly oiled or varnished, the floor to be supported on a sufficient number of pillars and also supported by truss work between the pillars. In order to prevent noise and vibration, this dynamo floor is to be disconnected from the building. The dynamo room will therefore be up

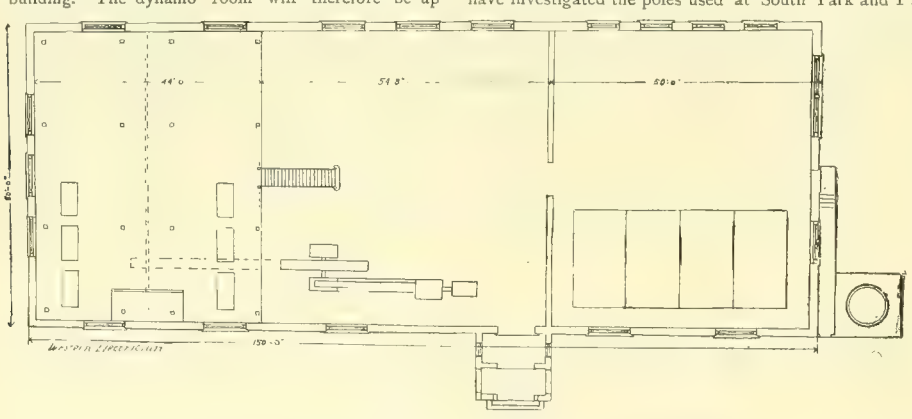


FIG. 2. WEST SIDE PARK LIGHTING SYSTEM.—PLAN OF POWER HOUSE.

out of the way and inaccessible to the public. The floor will be composed of insulating material, which is a valuable feature when currents of such high electromotive force are to be used. The dynamos will be permanently attached to the floor (sliding base frames will not be used) and will be driven by the jack-shaft from below by means of a rope-drive. This will enable me to permanently locate the dynamos, and to maintain constantly the necessary tension between the pulleys and the medium used for transmitting the power, without the necessity of bodily moving the dynamos for this purpose, as would be necessary when belting is employed to transmit the power. Another advantage of the rope-drive is the fact that the entire plant may be operated with but a fraction of the noise that would be produced when belting is used.

The arrangements which I have outlined will result in the production of a plant which may be operated with the minimum of labor and it will condense and individualize the duties and the work of the various employes.

*Dynamos and Circuits.*—I have considered it best to install the electrical portion of the plant in units of 125 lamps to each circuit, requiring one dynamo having a capacity of 125 2,000 candle power arc lamps for each circuit. The dynamos will be automatic in operation, so as to maintain a constant current under all conditions. The dynamos will each produce an electromotive force of 6,500 volts. This, you will understand, is a very dangerous current if the circuit is so placed that there is a liability of persons coming in contact with it; therefore, for this reason, I have located the dynamo room above the engine room, so that it may become isolated and not accessible to the public. Throughout the entire plant a wire will not be in sight. The dynamos will be located in the room in a symmetrical manner and in such a way that a single dynamo attendant will be sufficient. The room will be clear and free from shafting and belting, which will minimize the danger from accidents of any nature, while at the same time it will make a very beautiful appearance.

*Lamps.*—The lamps will be of the latest design and will be adapted to 20 hours' service with one trimming. By this arrangement one-half of the labor in trimming the lamps may be saved.

*Cables.*—The underground conductors will be composed of No. 5 B & S. gauge 98 per cent. pure copper wire insulated with an acceptable material sufficient to stand the voltage to which it may under any condition be subjected, and finally covered with an alloyed tubing composed of lead and from three to four per cent. tin. These conductors will be drawn into the conduits after the conduits have all been laid and are in place. By this arrangement any definite section of conductors may be removed and replaced without disarranging the entire system.

*Conduits.*—I would suggest the use of a conduit which may be made of pump-log, which consists of a piece of timber 3½ by 3½ inches square, cut in lengths of from six to eight feet and having a 1½ inch hole bored through the center. The sections are laid end to end in tenon and socket fashion so they will properly register and produce a full sized hole into which the cable may be readily drawn. I have determined upon the use of pump-logs for this purpose from the fact that they are as durable as any conduit I can find in the market unless we pay a most extravagant price for especially constructed conduit, which I do not advise. The conduit, properly built in the manner I have described, will last from 10 to 15 years, and if the cables do not deteriorate or give out within five years they may not be expected to give out in a much longer period; and the conduits are only necessary for mechanical protection and in case the cables are to be drawn in and out of place.

*Poles.*—I have given a great deal of thought and attention to the poles necessary for suspending the lamps. I have investigated the poles used at South Park and I believe every other pole throughout the city, with the result that I have designed a pole which I think will be much better adapted to our use than any pole I am able to find on the market, and I am pleased to say that the pole which I have designed will cost us not more than 50 per cent. of the cheapest pole I can find on the market at all adapted to our use. [Mr. Bain's design is shown in Fig. 4.] The new pole contemplates the use of a wooden section for its greatest length. This wooden section performs two offices —first, it reduces the cost of the pole, and the second and more important consideration is the fact that it insulates the upper portion of the pole, the lamp, hood and fixtures from the ground, and the manner in which the grain or end of the pole is protected from the weather will prevent early decay. The wooden section will consist of Norway or Georgia pine treated by having the sap and acid driven out and the pores or grain filled with creosote. With this treatment it will last as long as iron. Another feature which is quite important is the fact that the pole may be lengthened or shortened to suit the various conditions to which it may be applicable.

*Approximate Cost.*—An approximate estimate of the cost of the plant may be summed up as follows:

| | |
|---|---|
| 500 horse power water-tube boilers, set complete | $ 7,200 |
| Murphy or other automatic furnace or stoker | 1,600 |
| 500 horse power compound condensing Corliss engine, set complete, condensers, heating, piping, etc., included | 10,000 |
| Jack-shaft, clutches, rope-drive, complete | 2,500 |
| Five 125 light arc dynamos and 625 double-service arc lamps, complete | 35,000 |
| One extra dynamo | 3,000 |
| 300,000 feet underground lead-covered cable for 10,000 volts at 18 cents | 54,000 |
| 300,000 feet of conduit at 5 cents | 15,000 |
| 625 lamp poles, at $20 each | 12,500 |
| 26,000 feet rubber covered wire, for poles, at 5 cents | 1,300 |
| Extra labor and material for conduit, man-holes, etc. | 15,000 |
| | $157,100 |

Based upon 700 light capacity the cost per lamp is $244.44. The South Park plant cost $90,000 (original contract); having a capacity of 267 lights, the cost per lamp is $375.

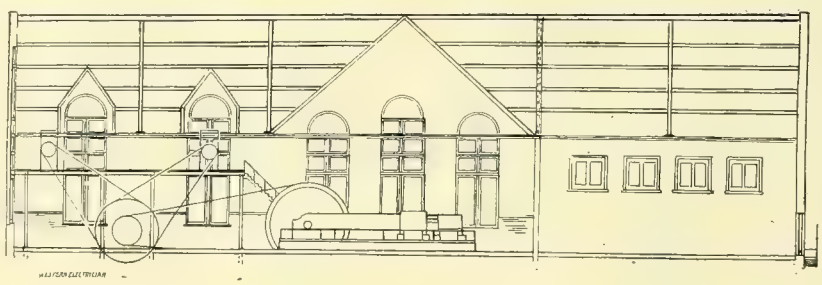


FIG. 3. WEST SIDE PARK LIGHTING SYSTEM.—SECTION THROUGH POWER HOUSE, SHOWING DYNAMO ENTRESOL.

In making my estimate I have itemized the various machinery and apparatus. I have included all such as may be required for this plant. In placing the prices I have made them conservatively high and I believe the variation that may result when given out in the competitive bids will be in favor of a considerable reduction from the prices which I have made.

The plant when constructed in accordance with the recommendations which I have made will be the very best that can be purchased, and it will operate at the highest economy. It will comprise the very latest developments in the electrical and mechanical arts. It will not include any apparatus or machinery that has not been thoroughly tried and in the operation of which there is not the scintilla of an experiment.

*Cost of Operation.*—An estimate of the cost of operation and maintenance of the electric light plant which I have outlined above will be itemized in the following:

The plant will consist of the highest class and the latest improved and best adapted machinery and apparatus, as previously described, to produce 700 double-service arc lamps of 2,000 candle power each. A lamp of this capacity is usually maintained at a difference of terminal potential of 45 volts with a current of 9.6 to 10 amperes. For our purpose we will assume the maximum 45 volts and 10 amperes; $45 \times 10 = 450$ watts. One mechanical horse power = 746 watts electrical energy, therefore an electric lamp of this size requires $\frac{450}{746}$ of one horse power or a little more than $\frac{7}{12}$ of a horse power theoretically. To reduce the entire number of lamps to watts we have $700 \times 450 = 315{,}000$ watts to be produced by the plant; to this we may add 10 per cent. loss in dynamos, 10 per cent. loss in shafting, hangers, ropes, etc., and 2 per cent. loss in the circuit = 22 per cent. loss. Our lost power equalling 69,300 watts, we must then have an engine large enough to produce $69{,}300 + 315{,}000 = 384{,}300$ watts. To convert this into mechanical horse power we divide it by 746 = substantially 500 horse power engine necessary to drive all of the dynamos and overcome the losses in friction, conductivity and resistance. Each lamp, including friction and loss, requires energy sufficient to produce substantially 550 watts. The efficiency of the plant is therefore shown to be 550 : 450 :: 1 : 81.8 per cent. from the engine to the current in the lamps.

If we can evaporate 10 pounds of water per pound of coal, and if our engine will deliver a horse power for 15 pounds of steam, then 1½ pounds of coal will produce one mechanical horse power including friction of the engine. Let us say on this basis that this assumption is correct; then assume that the engine absorbs 10 per cent. in friction. $\frac{33{,}000 \times .90}{\quad} = 19{,}800$ foot pounds per pound coal, and two pounds of coal would produce 39,600 net foot pounds per hour, or $\frac{39{,}600}{33{,}000} = 1.11$ horse power, or 10 per cent. more fuel than actually necessary, which we may charge to incidental loss.

I have been assured by the builders of the best compound condensing Corliss engines and water-tube boilers that the apparatus which I have described will produce one horse power per hour with a combustion of 1½ pounds of coal, and I have been told by the automatic stoker people that they can produce as much evaporation with one pound of coal costing $1.35 to $1.50 a ton delivered as can be produced by the best steaming coal when fired by hand. I have estimated that it will require two pounds of coal to produce a horse power hour. I know of several plants that are said to be burning only 1½ pounds of coal per horse power hour. These results may be tabulated as follows:

700 arc lamps require—
500 horse power,
2 lbs. coal per horse power hour,
1,000 lbs. coal per hour.
Coal costing $1.75 per ton.

| | |
|---|---|
| $0.87.5 | Cost of coal per hour. |
| .04.375 | " " oil and waste per hour. |
| 1.00 | " " carbons per hour. |
| .30 | " " engineer per hour. |
| .30 | " " electrician per hour. |
| .25 | " " fireman per hour. |
| .70 | " " four trimmers per hour. |
| 1.33 | " " deterioration and repairs. |
| 2.66 | 6 per cent. interest on cost of plant. |
| .541 | Incidental cost. |
| $8.00 | Total cost. |

700 lamps cost per lamp per hour, $.0114.
$7.98 cost of 700 lamps per hour.
$79.80 cost of 700 lamps for 10 hours.
$2,394 cost of 700 lamps for 30 days of 10 hours per day.
$3.42 cost per lamp per month.
$41.04 cost per lamp per year.

The cost per lamp per hour for the South Park plant is 2 cents, and on the basis of 10 hours per day and 30 days per month a 700 light plant would cost $4,200 to maintain, against $2,394, which I have figured to be the cost to maintain our plant. The difference comes in our adoption of larger units and consequently more economical operation. Andin acertain measure it is due to the fact that we are using fuel which will cost us not to exceed $1.75 per ton, against hard coal or oil, which they use, costing about three times as much. Again, our advantage is due to the increase economy

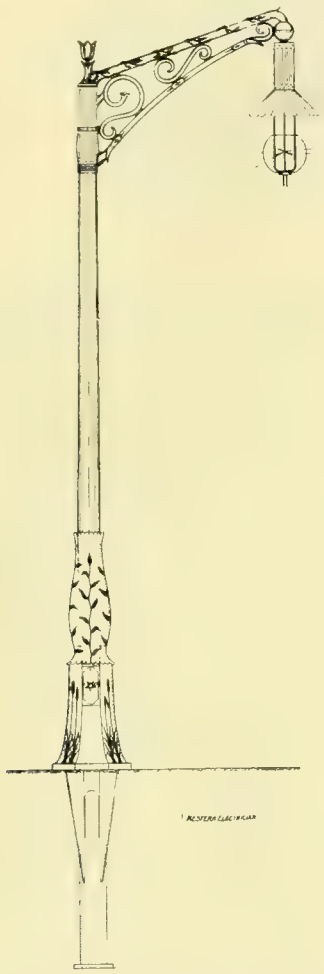


FIG. 4. WEST SIDE PARK LIGHTING SYSTEM.—PROPOSED ARC LAMP POST.

of condensing engines. A compound condensing engine has 40 per cent. higher economy than a simple engine, or it will do as much work with 60 pounds of coal as a simple engine will with 100 pounds of coal. In the South Park plant only a small portion of their lights burn all night, while their expense for labor is not reduced and fuel only slightly reduced, and the lamp hours are greatly reduced, making the cost per lamp hour much greater than if a full load were maintained during the entire run. I understand we contemplate the operation of the entire complement of lamps during the full period, making our conditions ideal for the cheapest and smallest operating expense.

In conclusion I will say that you cannot justly compare the operating expenses of any private commercial plant to the prospective expenses of our plant, first, for the reason that you cannot rely upon the information which they give out, and, second, from the nature of their varying load their expenses must be greater per lamp hour; nor can we compare the actual operating expenses of a municipal plant to what you may expect of ours, for the reason that there are political causes that usually increase the labor account far beyond that required to maintain the plant.

The figures I have given above may be relied upon as being correct in showing the expense at which the plant may be operated. The actual expenses for numerous reasons may vary somewhat.

The arc lamp post designed by Mr. Bain, Fig. 4, will carry the lamp 18½ feet from the ground. The base of the pole is a cast-iron casing extending six feet above the surface of the ground and five feet below, as shown in the cut. The buried portion is set in concrete and consists of a round hollow casting, with four outwardly projecting braces to give greater strength. The middle section of the post is a round wooden pole 6½ inches in diameter at the base and tapering to five inches at the top. This wooden portion has a 1¼ inch hole bored throughout its entire length and is set 22 inches into a tapering socket in the iron base. The socket is designed to leave a clearance of about one-half inch around the butt of the pole, at the top of the casting, and into this space oakum will be driven for eight or 10 inches and the juncture will be liberally coated with brimstone. The joint will thus be made impervious to moisture. The pole will probably be of Georgia pine subjected to special treatment and creosoted to make it lasting. It will extend into an upper hollow casting supporting an ornamental horizontal bracket for the lamp, provision being made, of course, for the wires. The lamp hood will be of cast-iron screwed into a gas-pipe nipple on the lower portion of the ball at the end of the bracket. The wooden pole will be 14 feet high, and the total height of the post about 20 feet. The lamp will be held out five feet from the post.

The lamp trimmers will be provided with an especially made buggy with a high seat so arranged that the workman need not descend to clean the lamp and renew the carbons, but can rapidly drive from one lamp to another, saving time and labor.

## Novel Applications of Electricity.

R. W. Hill presents in the London *Electrical Engineer* the following particulars of a simple but efficacious hygroscope with an electric attachment: Get a long hair from your lady friend, boil the hair for a while in a solution of soda, and one end of same attach to the brass or copper strip *1*, Fig. 1, as shown in the horizontal section in Fig. 2. To the other end attach a tiny dumbbell-shaped brass or copper *2*, electroplated with platinum. A small caoutchouc stopper *3* is provided with two hollow apartments, as indicated in horizontal section in Fig. 3. Put a few globules of mercury into them, and the two nails *4* are connected by a wire to the two terminals *5*. To the brass *2* is pasted a short piece of mica or straw *6*, and a small graduated paper scale *7* is fixed near the suspended brass, as shown on the rough sketch. Cover the device with a glass cylinder *8*, provided with a cap made of wire gauze *9*, and the hygrometer is now ready. When the air is moist, the hair shrinks, and the brass will be lifted; but when the air is dry, the little brass pendulum falls, closes the circuit of the bell, which will ring in a certain apartment in your house. In order to break the circuit, a one-way switch *10* is used. The stopper *3* may be made movable, so as to adjust the alarm to any desired degree of humidity or dryness. The brass *2* may be substituted by a short, thick platinum wire with straw attached, as shown in Fig. 4.

Every chemist has experienced the difficulty of removing the glass stopper of a bottle when it has become fixed—apparently immovable. Of course, one of the best remedies is to heat the neck of the bottle for awhile over a Bunsen burner. A serious drawback, however, of this old-fashioned method lies in the fact that the bottle must be held in a horizontal position, and the fluid or solution may be easily spilled out of the bottle if the operation is performed carelessly. I have solved this little problem in an up-to-date, efficacious manner by rigging up an adjustable clamp with coils of platinum wires embedded in a strip of asbestos attached to the said clamp. You press the circular clamp

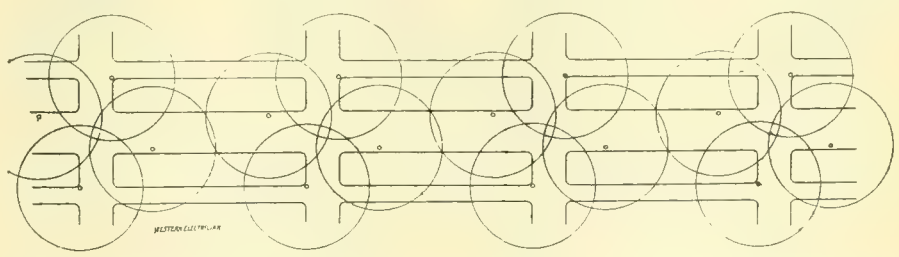


FIG. 5. WEST SIDE PARK LIGHTING SYSTEM.—DISTRIBUTION OF LAMPS ON BOULEVARDS.

round the neck of the glass bottle, then "press the button, and electricity does the rest."

The last novelty is an electric annihilator of moths, flies, and the like winged nuisances. It is an extremely simple though efficacious arrangement, consisting of an incandescent electric lamp placed inside a large glass globe, which is coated externally with a mixture of honey and wine or any other suitable sticky mass. Close the windows of the room, pull down blinds, close the doors, and make the room as dark as possible. Turn on the current, and a couple of hours later you will be surprised to see a lot of insects sticking to the said glass globe. The victims may be then "removed" with hot water, and the device is set afresh.

## Electrical Shams.

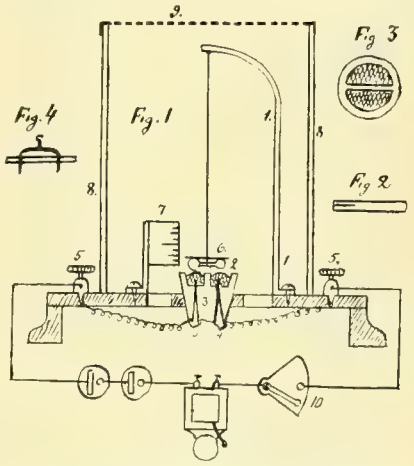
By O. M. H.

There is an acrobatic act, or turn, familiar to all who frequent the circus, where a number of performers execute a variety of gyrations, somersaulting and tumbling over each other in ludicrous haste, which never fails to elicit abundant applause. It is rapid but ridiculous, and exhausting enough to prevent its continuance to the point of tiresomeness, and it usually closes the performance of the tumblers.

The inventors of electrical supplies, metaphorically speaking, do much the same sort of hasty falling over one another in bringing out new ideas which prove "traps"—inventions which come so close to something before known as to remind one of the electrician's remark: "When we wanted to invent a dynamo we took the other fellow's machine and painted it red."

There are shams in the electrical business, more in proportion, as it seems to the writer, than in many another line of enterprise. The reason given—and no man ever did an unwise thing without an excuse for it—is that everything in the line of electrical goods must be cheap or it will not sell. A cheap article, to use common English, is a synonym for a nasty article; but aside from being worthless, when these are to be used in handling the electrical currents—used for illumination or power purposes—a positive danger lurks in the spreading of poor material or apparatus broadcast over the land.

Let us instance the wire sham. Certain requirements have been deemed essential in the matter of insulation. Tests are made and every honest, well-meaning firm of manufacturers is satisfied, willing and earnest in intention to furnish none but such an article as will prove itself satisfactory, and the grade is the same yesterday,




NOVEL APPLICATION OF ELECTRICITY.

to-day, forever. But the sham, with no other excuse than that "the contractors want a cheap wire, and we have to give it to them," manufactures and throws upon the market an inferior grade of insulation, or a thinner insulation of a good grade, or a wire below the gauge number, in order to compete with the honest dealer.

There are shams in switches. Certain requirements are made as to carrying capacity, material, length of break, etc., and while there is an abundance of kinds to choose from which answer every condition demanded, the sham's switch, in which there is too great an economy of base, too little of the stamped up metal, too great a sliding surface, eventually becoming metal covered, and hence a film of conductor between the poles of the switch, with the possibility of an arc and its resulting danger.

There are sham cut-out blocks made, in which the materials used, while standing a high test in the first instance, deteriorate and become a hazard, through constantly increasing conductivity. There are constantly developing tendencies to introduce new material as substitutes for glass and porcelain—something cheaper and poorer—which have constantly to be fought down by the legitimate and honest dealer and the right-minded contractor.

There is an insulator sham—yes; half a dozen of them—

which but for eternal vigilance would creep in everywhere and menace the property of an entire neighborhood.

There are contractors who are shams, who have had a limited experience at bell hanging and speaking-tube work, or have climbed a few poles for a telegraph or telephone company, whose business cards announce them as electrical engineers, who do their work by "rule of thumb," and not infrequently have to do it over again before it will pass an expert's examination—men who talk glibly of commentators and aconite wire, and the ohms of a current. The woods are full of them.

Unfortunately, there are shams in the ranks of the architectural profession—men who appear to be in it for the spoils; who argue with both hands, gesticulating with the right, while the open palm of the left is called attention to by the wriggling fingers. The architectural sham is a seeker after low bids, regardless of the shams which follow in their wake, and the sham contractor just fits his measure.

There is also the owner who wants something for nothing, and too often, by patronizing the entire system of shams, gets almost nothing for the something he pays, when dealing with electricity.

The proof that there is good foundation for all this statement of the electrical sham business can be had of any reputable dealer in electrical goods. But a valid endorsement is found in the reports of the Electrical Bureau of the National Board of Fire Underwriters, one of which is just fresh from the press. Many of the cases of fire from electric wires are clearly traceable to the fraternity of electrical shams. One hundred and thirty-seven cases of electrical troubles are reported for the last three months, and among these poor insulation, imperfect fuse protection, poor construction, unworthy switches and cut-outs, the placing of the latter in dangerous locatities—in one instance setting fire to hay in a stable—flexible cord in a cotton mill, want of protection for a portable lamp, combination fixtures without insulating joints, make up a large proportion. In fact, but few of the 137 cases reported could have occurred had a proper application of known electrical laws been intelligently heeded in construction and handling. One, however, stands boldly alone, attributable to the ignorance of an electrical engineer who had not yet had any cards printed. This in the report reads: "(889) Mechanic cut off cable with a pick. No fire insurance loss."

And there is another grade of shams, who look wise and see mountains in molehills and overlook real causes for criticism in their zeal to appear learned, and claim to be authority on subjects they are perfect novices in; they belong in the kindergarten class of electricity, and they accept, as up to grade, installations which are a disgrace to the constructor, a menace to the owner, wasteful as well as dangerous, and in nowise meritorious. They, the homespun insurance inspectors of the rural districts, rely more for safety on the sparsely settled condition of the district in which they work than on knowledge with which to earn their too poorly paid stipends. They are shams by force of circumstances.

There is a sham of still higher grade, who relies upon his monetary robustness to carry his point. He has neither fear nor favor to ask of his weaker brethren. His early teachings at his mother's knee are forgotten, and the ten commandments are so muddled in his brains that he cannot distinguish which are "thou shalt" and which are "shalt not;" and rather than refer to the original he prefixes the "shall" when he desires to possess and "shall not" when it comes to acknowledging the rights of others. There are hundreds of these shams abroad in the land. They lie in wait for the brainy inventor's exhibit and gobble it. The Patent Office reports are full of their attempts at larceny; the courts are crowded with litigious graspers, struggling for supremacy, while the original suggestor or inventor too often loses all. This is no fancy sketch, and it has become the rule, rather than the exception, that an electrical patent is of little protection, provided it is valuable, unless it has first wasted the greater portion of its natural life in legal wrestling. It seems to be a rule that

He shall take who has the power,
And he shall keep who can.

## Charge Against a Street Railway Company.

Marcus C. Gormley has filed a bill in the Circuit Court for a receiver for the assets and franchises of the General Electric Street Railway company of Chicago, and also to cancel a quantity of stock which he says has been issued to various persons. In August last, the court is told, the General Electric Railway company employed the complainant to "promote" the company, which, it was represented, had a capital of $5,000,000, the stock being paid for by a number of valuable patents. For his services, the complainant avers, he was to receive 500 shares of stock. Thereupon, Gormley says, he procured capitalists willing to advance $250,000. After he had done this, the complainant says, he discovered that the company did not intend to secure franchises to operate street railway lines, but simply intended to obtain franchises to sell to others. Mr. Gormley claims that if this is done he will be held liable upon the stock held by him and will have to pay out large sums of money, as he declares the company is buying frontage consents by offering stock in the company for signatures. In short, the complainant says that the company is not living up to its organized purpose, but is simply in the speculation market.

An electric light plant is in contemplation at Kasson, Minn.

## The Subway in Boston.

The Boston Transit Commission, which might more properly be called the subway commission, has just issued its first annual report for the year ended August 15th. This report is practically the story of the subway, now partially completed, on which the people of Boston pin their faith as the structure which shall solve the rapid transit problem. The report presents in detail the reasons governing the board in adopting the subway plan in preference to the proposition to build elevated railroads. The prevailing idea seemed to be to remove all possible encumbrances from the public highways rather than place new obstructions in these narrow and already overcrowded arteries of commerce.

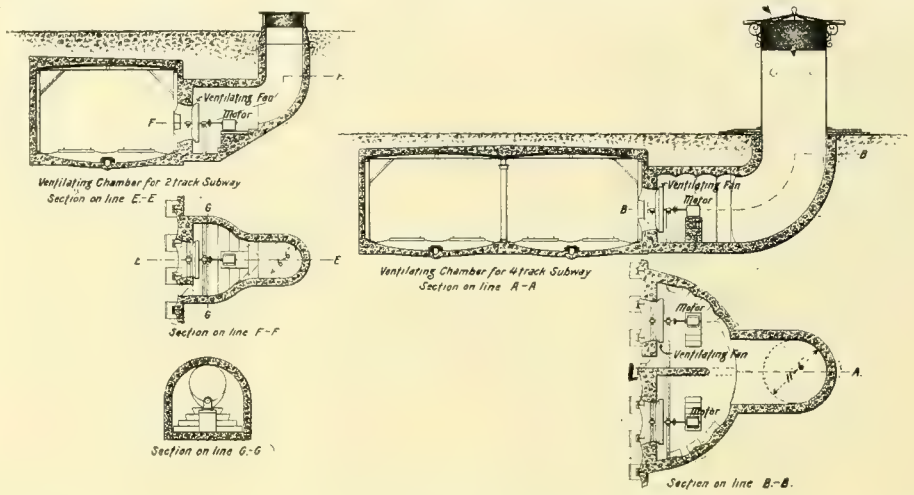



FIG. 2. THE SUBWAY IN BOSTON.—PLAN FOR VENTILATING SUBWAY.

Accompanying the report of the commissioners is the report of the chief engineer to the board, Howard A. Carson. In this supplementary report the chief engieeer says that the department has made about 650 plans. Under the caption "Studies for Cross Sections" is the following:

Numerous studies have been made in regard to the cross section of the subway. Three types (illustrated in Fig. 1) will be alluded to here.

Type A has masonry side walls and a roof consisting of a masonry arch with its axis parallel to that of the subway. Type B has also masonry walls, but its roof is composed of jack arches of masonry resting on steel I-beams whose axes run crosswise of the subway. Type C has a roof like that of type B, but its side walls consist of concrete masonry strengthened by steel I-beam columns.

Arched masonry structures resembling type A have long been made use of in various parts of the world. One advantage of this construction is that as far as the chemical destructive agents ordinarily found in the ground and atmosphere are concerned, it will last for a very long time, perhaps for centuries. Another advantage is that its arch can be built a little at a time, a characteristic that may be extremely useful in some parts of the subway. Its principal weakness consists in the fact that with such thickness and other dimensions as are practicable for the subway it requires the lateral resistance of the earth on its sides, or some substitute therefor, to resist the thrust of the arch and thus maintain its stability, and that it is liable to be crippled by unsymmetrical loading. The commission early decided that the subway be placed as near the surface as is practicable. Among other reasons for this decision are the following: Such position causes the least amount of excavation and expense in that particular; it is least likely to injure buildings and their foundations; and it will lessen the number of stairs at the stations for the people using the subway. In many cases along the route of the subway the sidewalks are hollow, having vaults under them. An arched structure of the form of type A, and with the dimensions and thickness necessitated by subway conditions, could not stand in a position where abutments would thus be lacking, unless some substitute for these abutments should be provided. It would cripple with a very light load. Even where solid earth abutments could at first be found, as in the Common, digging on one side for a sewer trench or similar purpose might seriously injure the arch. If placed at a sufficient depth, however, it would in many respects be an admirable construction for the subway, and where conditions require that the subway shall be placed at such a depth as to be considerably below the areas formed under the sidewalks, and so low that it is not liable to be injured by digging for sewers or other purposes, then type A can be made use of. It is also probable that type A can be used to advantage in other situations, if strengthened by steel tie rods. These tie rods, however, must necessarily be placed 14 feet or more above the surface of the rails, so as not to interfere with the passage of the trolleys, and they introduce an objectionable feature presently to be noted in regard to types B and C.

The objection to type B, and still more to type C, is the liability of the steel beams to lose their strength by oxidation. Although iron and steel, in some situations, have been seriously injured by oxidation in a few years, yet there is ample evidence that in numerous cases iron has been made to last for centuries. At least 1,800 years ago the Romans made use of iron cramps to strengthen the stone masonry of the colosseum and other buildings. Most of these that were easily accessible were cut out during the Middle Ages to make weapons, but many can be found unchanged at the present time.

Lead was used to secure the cramps in position, and this

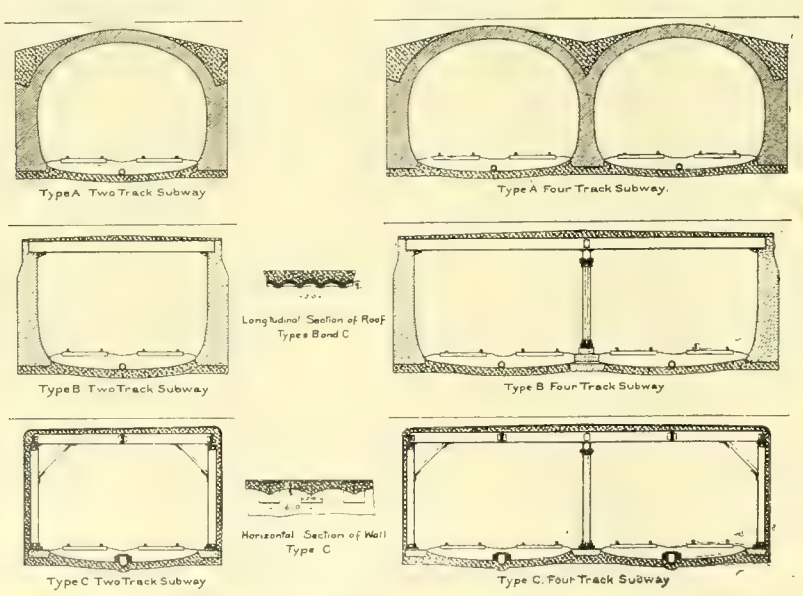



FIG. 1. THE SUBWAY IN BOSTON.—TYPES OF CROSS-SECTION OF SUBWAYS.

in many cases served to protect the iron. Cement and concrete often served a similar purpose. Similar methods have frequently been used in Europe through succeeding ages, and abundant examples are to be found to-day in many cathedrals and elsewhere. Steel can now be had so much more easily and cheaply than formerly that, as is well known, it is far more extensively used in connection with masonry, especially in places where great strength is required in small space. It is believed that well made cement concrete surrounding steel will protect it from ordinary rust for a long series of years. This belief is founded on personal study, and on the concurrent judgment of engineers and others who have had extended experience and who have given the subject careful attention, and is supported by the weight of material evidence.

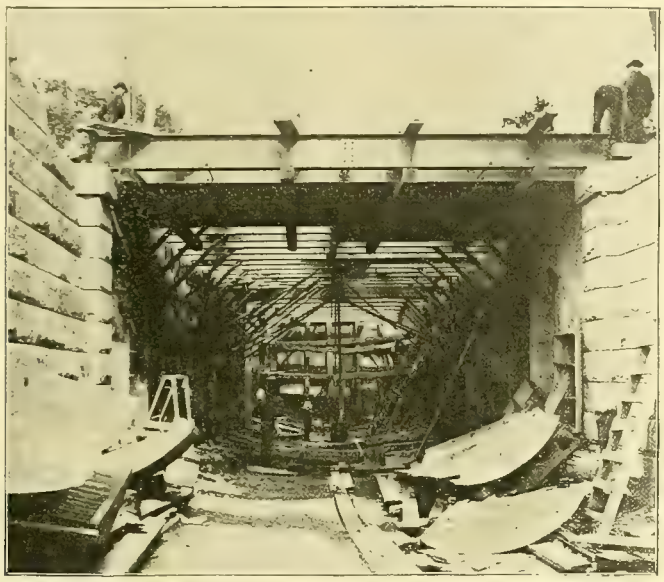


FIG. 3. THE SUBWAY IN BOSTON.—IRON WORK AND ROOF.

The question of prevention of injury from electrolysis is one that demands careful attention. Isaiah H. Farnham and Messrs. Stone & Webster have been consulted in this matter. Mr. Farnham is well known for his studies and experiments in this direction. Stone & Webster have acted as experts for the Boston Water Board and for various water companies and street railway companies. Mr. Farnham and Stone & Webster unite in saying substantially that it is practicable and feasible to so protect the iron and steel work that it will suffer no serious corrosion by electrolytic action; that the cost of so doing will be comparatively small, and that it will be easy for competent men to determine from time to time whether or not danger from electrolysis exists.

It thus appears probable that the iron and steel used in the subway can be so protected as to last for a long time. Calculations and experiments have been made that appear to show that with the character of earth found on section 1 and many other parts of the subway, the side walls of concrete as arranged in type C might continue to answer every purpose, even if the steel in the side wall should almost entirely rust away.

Type C has other advantages. It has strength and stiffness to support loads and resist pressures admitting of much more definite calculations than is the case with constructions composed entirely of masonry. The strength of the steel members is, of course, to be had at once. In this respect it differs from cemented masonry construction, whose full strength is not to be had for months. With the prices of steel which prevailed last March, the cost of type C was much less than that of type A, if type A were constructed of brick. It occupies less width, and is, therefore, particularly advantageous where ample space is lacking; ample space is lacking for most of the subway route, even in the Common. Its greatest advantage, however, lies in the fact already stated, that it is not liable to be broken down by unequal loading on top or by making excavations on the side.

Several eminent and experienced engineers were consulted on this question. A majority favored the use of type C, and none opposed it, and this type was adopted for section 1 of the subway.

The experience gained in its use on that section will of course be made use of in any similar designs which are made later. Types B and C will both probably be made use of in the work that is to follow, and type A, with or without steel tie rods, will be employed in a considerable portion of the subway.

In regard to the ventilation of the subway, the plans for which are outlined in Fig. 2, the following remarks, in the main condensed from a report of Professor S. Homer Woodbridge, are offered by Mr. Carson:

The ventilation of a subway or tunnel, the traffic through which is by means of electrically driven cars, is a much simpler undertaking than if the motive power were furnished by steam engines or even by horses. A locomotive burning 35 pounds of coal per mile of run produces at a running rate of 15 miles per hour about the same quantity of carbonic gas and of water vapor as 22,000 average adults in a state of repose, besides emitting an indefinite though troublesome, if not dangerous, amount of smoke, and sensible traces of carbon monoxide and sulphurous gases to still further vitiate the air. If steam locomotives were to be used in the subway, probably at least 30 times as much fresh air would be required to ventilate it as with electric propulsion; hence the somewhat plausible reasoning of some that the subway will need no other ventilation than that obtained by natural wind currents and the pumping or plunger effect of the movement of cars through it.

Another of the chief difficulties usually attending tunnel ventilation is in the case of the subway largely reduced; namely, the disturbing effect of wind, which entails that the point of ventilation shall shift with the point of maximum vitiation fluctuating to the leeward. In the case of the subway, the depressed position of the entrance ways, both terminal and intermediate, and the protection furnished by the surroundings, will serve to lessen the effect of wind in producing air-flow through the passage, so making the conditions favorable to ventilating by means located centrally with reference to portals or other main openings.

In a general way, for purposes of ventilation, the subway for the present may be said to be divided into sections of 600 feet, each section being furnished with a fan of sufficient power, when run at moderate speed, to remove the total air contents of its section once in 10 minutes, or once in seven minutes, when the fan is run at a maximum intended speed. The corresponding rates of air-currents within the subway will be from 60 to 86 feet linear flow a minute.

That method, making the subway itself the airway and the velocity of flow slow, reduces the frictional and pressure work upon the fan to a minimum, and hence, also, the power required to operate it. To provide a system for air movement and distribution which would be "theoretically" and elaborately perfect would be economially an error. Such a system might easily consume more power than the entire train of cars moving through the subway.

The number of fans may reach 12, and the usual aggregate volume of air moved will exceed 12,000,000 cubic feet per hour, and may be made to reach 18,000,000, or a sufficient quantity to meet all demands. Additional ventilating chambers can be made, in the future, if there is any occasion therefor, or any of the present ones can be equipped with more powerful fans.

The form of fan is one chosen as the result of exhaustive tests recently made. The fan for the two-tracked sections is seven feet in diameter, and that for the four-tracked, eight feet. In action they will draw air from the tunnel and expel it through specially provided chambers and vent-shafts located at one side of the tunnel. The fans will be driven by electric motors, and each large fan will, when run at average speed, consume about the same power as a single car in motion.

The entire design has reference to ventilation by the output of vitiated air rather than the input of fresh air, the movement of one necessitating in either case a counterpart movement of the other.

The report is profusely illustrated and contains also a large number of maps and plans. Fig. 3 gives a view of the iron work and Fig. 4 shows the portal at the public garden. The subway commission is composed of Hon. George G. Crocker, chairman, Charles H. Dalton, Thomas J. Gargan, George F. Swain and Albert S. Burrage. Public acknowledgment is made to Philip L. Saltonstall and Walter H. Knight of the General Electric company for suggestions in regard to trolleys and trolley arms, which were of benefit in determining the height of the subway.

The estimated cost of the subway when completed is $5,000,000, and this includes the necessary real estate for terminals.

Briefly, the method of construction consists of side walls of steel I-beams imbedded in concrete, supporting a roof consisting of transverse steel beams or girders with brick and concrete arches between them. The standard height is 14 feet clear above the top of the rail, the width for two tracks 24 feet, and for four tracks 48 feet. The four-track subway will have a line of steel posts along the center. The top of the rail will be about 17 feet below the surface of the street, and the station platform about 16 feet. The staircases leading to stations will be covered and enclosed, and the platforms generously proportioned. The platforms are so-called "island" platforms, that is, they have a track on each side of them, so that all necessity of crossing tracks in the subway is avoided.

The designs prepared contemplate the use, when needed, of fans between the stations to exhaust the air and secure thorough ventilation of the subway. Fresh air will be drawn in at the stations, and will flow in each direction to the ventilating fans, where it will be exhausted through special openings at the side.

The subway will be lighted by electricity, the current for which will be derived from a special plant distinct from that used for motive power and for lighting the cars.

---

A flywheel burst in the power house of the Albany Railway company November 12th. Four persons were injured, one of them mortally in a saloon opposite the power house. One piece of the wheel tore out the whole front of the saloon, and another the whole upper portion of the house. Nobody in the power house was hurt. The house of Mrs. Elizabeth Metz, two blocks away, was wrecked by a flying piece of the wheel, eight feet long and four feet wide, and weighing 4,000 pounds, which descended in a slanting course, striking the top of the house and tearing out a whole side. A section of the north side of the power house, 25 feet wide, and extending from the ground to the roof, was torn out and one of the engines and a generator were demolished. The damages amount to $30,000. Travel on all the lines of the railway company was suspended for two hours.

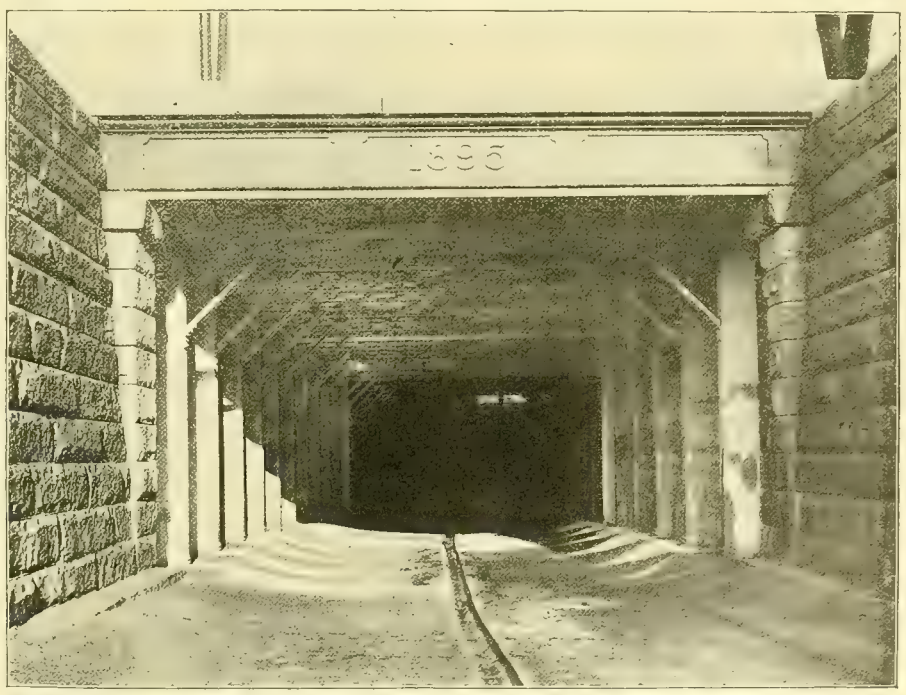


FIG. 4. THE SUBWAY IN BOSTON.—PORTAL, PUBLIC GARDEN.

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CIRCULATION, 16,630.

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AT the Washington convention of the Brotherhood of Electrical Workers a resolution was passed recommending the establishment of a "home" for aged and infirm electrical workers, yet the daily newspapers persist in the assertion that "electricity is still in its infancy."

ELECTRICAL shams are numerous, and their consideration is at times forced upon the trade. The tone and spirit of the article on this subject which is published on another page this week are highly commendable, but there is one important omission which detracts somewhat from the otherwise comprehensive character of the article. Our contributor carefully avoided mentioning names for reasons which, no doubt, he considered good and sufficient, but there can be no question of the propriety of here calling especial attention to the greatest electrical sham of the age, John P. Barrett.

MAYOR SWIFT, in response to the almost unanimous demand of the property owners and occupants of stores and offices on South Clark street, has withdrawn his opposition to the extension of the trolley between Adams street and Washington street, and the amendment to the ordinance granting the Chicago City Railway company the right to extend its trolley line to the city hall has been formally approved. At Monday night's meeting of the Chicago City Council the mayor announced his decision to approve the ordinance. This may be considered one of the most important victories gained by the overhead trolley in Chicago, as it provides for penetrating the very heart of the retail business district of the city. The North and West Side Street Railroad companies which have been compelled to drag their trolley cars through this district by horses or attach them to cable trains may now be expected to demand similar privileges for their lines.

MILWAUKEE repudiated the city lighting project which was planned much after the style of the Barrett scheme in Chicago. Our neighbors up in Wisconsin saw what a botch had been made of the street lighting in this city. Many of the Milwaukee aldermen had personal grievances against the local company, yet in venting their spite they were afraid to go to the extent of committing the city to such a policy as that which Barrett had saddled upon Chicago. They have no confidence in the "professor's" claims or his ability, and they look upon the street lighting system of this town as a horrible example of the inefficiency of municipal ownership schemes.

A PRACTICAL illustration of the efficiency of the electric heater for street railway service is being given on the trolley lines of the North Chicago Street Railroad company. Handsomely finished and brilliantly lighted vestibuled cars have been placed in service on the trolley lines, and the latest convenience, the electric heater, is regarded by patrons as a great luxury. The temperature of the cars thus equipped can be nicely regulated and the heat evenly diffused. Many persons going down town nowadays leave the North Clark street line at Division street and take a North State street electric car, even though the change entails some inconvenience and an additional five-minute walk at the other end of the line. But it all goes to show that people will patronize those lines that are supplied with the most conveniences.

THE findings of the United States Circuit Court in the Nebraska district, which were reversed by the Circuit Court of Appeals, have been sustained by the United States Supreme Court in the case of the Western Union Telegraph company, which claimed an exclusive right to maintain telegraph lines along the route of the Union Pacific Railway company. The decision holds that the United States has a right to maintain a bill in equity to compel the Union Pacific to maintain its own lines of telegraph along its railroad routes, and that the obligation imposed on the railway company to do this is as strong as its obligation to maintain the railroad tracks. In the opinion accompanying the decision Justice Harlan, speaking for the court, said that the Union Pacific Railway company had no right to make a lease practically giving the Western Union Telegraph company an exclusive right to maintain telegraph lines along the route of the railway company. This litigation has been drawn out to such an extent that it will be a great relief to have it disposed of finally.

AT last it has come to pass. The new woman is hobnobbing with the old ladies on Indiana avenue. The cobwebs on that ancient thoroughfare are in danger. And it is all on account of the trolley. In their frenzy these well meaning but deluded matrons have welcomed the frivolous hussy to their ranks. Probably they had never heard of her before, owing to the seclusion of their retreat, but she has at last gained admittance, and they will find it difficult to dismiss her from their ranks. "The New Woman and the Anti-trolley war" was the subject of a paper read at the last meeting of these defenders of the roadway. It is said that the old ladies were much pleased with their young acquaintance—among themselves—and while it is hardly possible that they would patronize her to the extent of introducing her in their families, they consider that she is just the girl to talk back to the street railway magnates. In her pert way she mixes her facts and fancies, but that is because of her enthusiasm for the cause, and it serves their purpose just as well not to stick too closely to facts, for they find them inconvenient at times.

THE alarming prevalence of crime in Chicago at the present time is attributed to the fact that the streets are so poorly lighted that it is possible for thugs and footpads to hold up their victims even in the business district of the city. The responsibility for this condition of affairs rests with John P. Barrett. Acting upon his advice the city has refused to make contracts with commercial lighting companies for furnishing street lights, and of course Barrett is thoroughly incompetent to plan and execute a project of such magnitude as the successful lighting of Chicago's streets. He attempted it and failed, as was to be expected, for the "professor's" stock is composed chiefly of egotism and a political pull. These would not carry him very far in such an undertaking. Hence his failure is complete, and the city finds itself with a costly equipment upon its hands which, through mismanagement and neglect, has become worthless so far as practical results are concerned. Barrett's reports show that the city lighting project, financially, is a most lamentable failure. In every way, therefore, the people of Chicago have been sorely afflicted by Barrett and his schemes.

IN another column is presented a review of the first annual report of the subway commissioners of the city of Boston, in which the plans adopted and now being executed are explained. The conditions which confronted the commissioners were unusual, and under the circumstances their decision to build a subway can readily be appreciated. The narrow streets of Boston are already overcrowded and any additional incumbrance would mean practically to choke them completely. It would have been absolutely necessary to widen the present streets considerably, and, aside from the damages to property that such a plan would entail, the building of elevated roads would have been opposed much more persistently than the underground scheme, because it would have been necessary to disturb many time honored scenes, and change the whole face of the city. The engineers in charge of the work have carefully considered the many-sided question, and their recommendations show that they have taken into consideration the conflicting interests which must be harmonized or satisfied. The project is full of interest to all large cities where rapid transit problems are urging themselves upon the municipal governments and the people.

IT is pretty generally known that the Postoffice Department of the United States government is collecting information regarding telephone matters in this country and abroad, including cost of construction, maintenance and operation, and the value of existing patents. The object of this investigation is said to be to place at the disposal of the postmaster-general the information necessary to the consideration of the subject of introducing the telephone in the Postoffice Department. Among those who have been consulted on the subject there is much hope that this matter will be considered in the forthcoming report of the postmaster-general, and that he will recommend the utilization of the telephone in the department. Friends of the scheme take pains to disclaim any intention to bring about governmental ownership of the telephone. They evidently remember the experience of the last administration with the telegraph, and they express a desire to avoid the mistakes that were made in the advocacy of Mr. Wanamaker's plan. It seems rather difficult to devise a scheme by which the telephone can be made a valuable adjunct of the postal service without infringing the rights and privileges of existing corporations, especially those of the Bell company; yet the projectors of the scheme under consideration claim that this can be done, and that the telephone business of the country will be greatly benefited by the new arrangement. There are, it is true, many conflicting interests to be considered. In the first place it will be necessary to utilize all existing exchanges and encourage the extension of the present lines, whether controlled by Bell or anti-Bell companies, in order to secure the best possible results from the operation of the scheme proposed, and right here complications may be expected to arise. Thus far the Bell company has steadily refused to make any arrangements for service with companies or individuals using instruments not of its own manufacture. It is not to be expected that it will recede from this position without a desperate struggle unless some concession is made that will fully compensate it for any real or imaginary loss. By granting such concessions the government is sure to awaken the resentment of the outside companies, who will of course object to serving as the tail for the Bell kite, and inasmuch as the present plan depends upon these anti-Bell companies for support, the project is bound to fail without their co-operation. It should be noted that the spokesman for the anti-Bell companies asserts that all of these matters have been carefully considered and that ways and means have been devised for avoiding any conflict of interests, but further particulars can not be gained until the plans of the postmaster-general are completed and placed before Congress for consideration. The scheme is one of absorbing interest, and if put into operation will exert far-reaching influence. It will affect the rights and privileges of a great corporation that has been the recipient of unusual favors at the hands of the national government. It will mark the beginning of a new era in the postal service. And, it is believed, it will prove an advantage to the anti-Bell telephone interests and to the industry in general.

## The Motor and the Watch.

By C. C. Haskins.

In one of the motor cars which runs into the city a gentleman apologized, while asking the time of his next neighbor the other day, by telling how his watch, which had never done him an ill turn in many years, had suddenly become as unreliable as a "Waterbury."

The owner of the lying timepiece was thoroughly ignorant of the cause, and quite astonished when it was shown that in all probability it was magnetism from the motor which had demoralized the time-keeper.

The general public does not understand that magnetism, unlike electricity, cannot be insulated. It may be absorbed, but the absorbing material must be para-magnetic, that is a metal or something which can be magnetized. The most susceptible material of that nature is iron, either in the pure state or carbonized, or steel.

"But how," he asked, "does magnetism get into the watch, and what does it do when it gets there?"

To make the matter plain, something like this was said: In the first place, know that certain metals have no affinity for magnetism, cannot be affected by a magnet, as lead, tin, copper, etc., while others, notably iron and its compounds, are not only capable of being attracted by it, but will retain a certain amount, or in other words become magnets and remain magnets until that magnetism is removed.

There is a great deal more of this permanent magnetism scattered over the earth than is generally known. If you take a needle from a package in a store, if the package has been lying in a north and south position you will see it is a magnet if you float it carefully on the surface of a glass of water. It will turn round, and point north and south, like a compass needle. In that case the magnetism comes from the earth's polarity.

If, with a compass needle you test the rail of a street car line (not an electric road), you will find that rails lying east and west are polarized crosswise, while those lying north and south are polarized lengthwise. Nearly every piece of permanently fixed iron will show polarity—that is, show that it is a magnet, more or less powerful according to circumstances. The purer and softer it is, the more readily it is affected, and the sooner it loses the property of magnetism, while the reverse is true with impure or hard iron, steel being least readily affected, but retaining the magnetic property more persistently.

Now, although gold and silver and brass are all non-magnetic, the watch is not wholly composed of these metals. The main spring of your watch is fine steel, and several other portions of the watch are of the same metal. The magnetizing of the main spring, the case spring, screws, etc., will generally do little or no harm, for these are comparatively stationary. But the little hair spring, which oscillates back and forth many times in a minute, is also steel, and being magnetized is irregularly acted upon by the magnetic force of the earth—the same force which tends to hold the compass needle in a north and south position.

When your hair spring winds up, it is pulled either one way or the other by the earth's magnetism, or by some other magnet, according to the position of the watch, and when it unwinds it is pulled in the opposite direction, and the constant worrying of the little, delicate spring will thoroughly discourage it from doing perfect work. This little spring averages about five movements per second, or in round numbers 432,000 per day, so that a very slight acceleration or retardation of its motion at each beat would aggregate many minutes in a week.

But there is another affected portion in a watch, if magnetism gets into it—the balance wheel. This is sometimes made up of metals which have different co-efficients of dilation and contraction, so that in all changes of heat and cold the size of the balance wheel, and consequently its rate of movement—five times per second—will remain constant. This is sometimes made of para-magnetic metal and may be affected by magnetism.

Now, as the iron safe in your office, the iron joists under the floor, the iron front of the building, the columns and pretty much everything else iron in the vicinity of your desk is more or less magnetic, and as the opposite poles of magnets attract each other, and like poles repel each other, your watch may be in close proximity to a moderate magnet all day, and if it is magnetized, why the safe or the railing would have more effect on it than if it were free from that property.

The motor under the floor of the car creates what electricians call a magnetic field in every direction, and this influence, while it is nothing that can be weighed, tasted, felt or seen, saturates the air and everything surrounding it, with a decreasing density as you recede from the pole of the machine. At the pole it will hold several pounds of iron with a force requiring a hard pull to release it when in actual contact. A hammer, a heavy wrench, or a spike will be jerked out of your hand at a distance of an inch or more.

Now, there is no insulator for magnetism. The floor, he seat, a cushion, clothing—none of these are competent to stop the effect, and distance only weakens the field of saturation. A plate of iron may absorb the magnetism in part, but this acts more in the capacity of a strainer than of a complete shield.

And that, sir, probably tells where your watch trouble is.

## Electric Train Lighting in South Australia.[1]

By Clement F. Street, M. E.

The United States can justly claim the best lighted railway trains in the world, and as some of the Australian colonies are following in our footsteps in many railway methods and appliances, they are making improvements in lighting. Pintsch gas is extensively employed and in New South Wales the gas used is made from a petroleum shale which is wonderfully rich in petroleum and can be obtained from a surface mine at a very small cost. In South Australia on the South Australian government railway an experimental electric lighting plant has been introduced on one train and is giving excellent results so far.

The lighting of this train is carried out by means of a charging dynamo and storage cells fitted up in the brake van. Incandenscent lamps of five and 10 candle power are placed in the second and first-class carriages respectively. The charging dynamo is driven from one of the brake van axles by means of a link leather belt running over two flanged jockey pulleys which slide on vertical standards above the dynamo pulley. The belt is kept tight by strong spiral springs which are placed under the brackets which carry the jockey pulleys. The tension of these springs is regulated by screws so arranged that the jockey pulleys can be lowered a distance sufficient to stop the motion of the dynamo by slackening the belt on the van axle pulleys. The latter pulley is provided with deep flanges for keeping the belt in position when slackened.

The output of current from the dynamo is regulated by a centrifugal governor, which is belted to the dynamo shaft. When the train attains a speed of 25 miles per hour the movement of this governor automatically couples the dynamo to the cells and the lighting current and also keeps the output of the machine constant, with any increase of speed above that rate. If the speed should drop below 25 miles per hour the current is broken again by the governor. The machine is capable of an output of 80 amperes at 65 volts. The storage battery consists of 24 cells, each having a capacity of 550 ampere hours. These are distributed about the brake van so as to equalize the weight upon the trucks. The charging rate of these cells is 55 amperes and the dynamo is arranged so as to charge the cells at the maximum rate at the same time that it is lighting the lamps in the train.

When it is necessary to charge the cells a special attendant is sent out with the train for the round trip from Adelaide to Terowie, a distance of 280 miles, during which the cells are charged to their full capacity. The lighting of the train on the following one or two trips is performed by the storage cells; the number depending upon the size of the train and the season of the year. The coupling of the connections between the vehicles and the switching on and off of the lights is carried out by the guard in charge of the train, who also takes frequent records of the amount of current used upon the journey. As soon as the amount of current used on these non-charging trips approaches the quantity which can be stored by a round charging trip, the special attendant is again sent out with the train, and the cells are recharged to their full capacity. The charging machine is never run except under the charge of the special attendant; at other times it is thrown out of gear by slackening the belt. On an average it is necessary to charge the cells every second trip in the winter and every third trip in the summer.

Each first-class compartment is provided with two 10 candle lamps, while each second-class carriage and the brake van has three 10 candle power and two five candle power lamps each. Two lamps are placed in each compartment so that light may be maintained in case of the failure of one of them. The floor space of each compartment is 52 square feet. The number of vehicles in the trains varies from six bogie carriages and a brake van, representing 25 ten candle power and 35 five candle power lamps, to four bogie carriages with a van having 19 ten candle power and 28 five candle power lamps. The cost of installing the plant in a train consisting of five composite carriages of six compartments each, one lavatory carriage and one van, was $3,950. The cost of maintenance, renewals and repairs per week under the present running conditions, is as follows:

| | |
|---|---|
| Wages of attendant, supervisor, etc. | $11.81 |
| Maintenance and renewals of storage cells, machinery and appliances, lamps, oil, waste, etc., average cost per week | 6.62 |
| | $18.43 |

The cost of lighting with kerosene previously was $20 per week. There have been practically no failures during two years. The lights were not used on two occasions on account of imperfect coupling between the carriages. The system is looked upon as successful in every way, and it will probably be extended in the near future. In drawing comparisons between this system and those in use in this country it must be borne in mind that the light given is not as good as that usually required, and is inferior to that given by a good distribution of our oil lamps of good make.

1. From the *Railway Review*.

## Electrical Exports.

For the week ended November 8th the exports of electrical material from the port of New York aggregated in value $22,000. The goods were shipped to Belgium, France, Great Britain, Germany, Italy and to the Central and South American countries.

## Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

Hiram Dotson of Spearfish, S. D., is soliciting subscribers to a telephone system which he proposes to put in in the Black Hills. He wants 200 subscribers to take a year's service at $100 each. At the end of that time he agrees (and offers a bond to secure it) to turn over the system to the subscribers. He guarantees that it can be run for $3 per month if there are 150 subscribers.

The Madison, Wis., school board has contracted with the Dane County Telephone company to put telephones in all the ward and high schools.

The Merrill Telephone company of Merrill, Wis., has closed a contract with the Standard Telephone & Electric company of Madison, Wis., to construct an exchange. It is to be completed by December 10th.

A. G. Fuller has been in Duluth recently to arrange for long-distance telephone connection for Duluth and Superior and the Twin Cities with Chicago and the East. The long-distance wires now reach Milwaukee, and it is proposed to extend them via Eau Claire, Wis., to the Twin Cities, with a line from Duluth connecting at Eau Claire. He thinks the service may be completed within a year.

The Northwestern Telephone Exchange is improving its system at Winona, Minn., and preparing to make long-distance connection with La Crosse, Wis.

The Black Hills Telephone company has decided to continue its central office at Rapid City, S. D., having received several new patrons. The new rates charging toll for communication with all the towns in the Hills except the local one went into effect the 1st and caused considerable dissatisfaction.

Messrs. Haines & Melone, operating the Rochester, Minn., telephone exchange, are soliciting subscribers at Oronoco, Minn., with a view to connecting with that place. A line to Stewartville is also contemplated.

The people of Mankato, Minn., are impatient over the continued delay of the Phœnix Telephone company, which was granted a franchise there some months since. M. Rumuey, their superintendent of construction, visited Mankato but did no work aside from soliciting contracts for about six weeks. The franchise expires in December, and the prospect for a telephone exchange in the time agreed does not seem very bright. They secured about 150 subscribers.

The telephone war at Wausau, Wis., has reached the point where the old company has agreed to give subscribers a year's service for $1. Most of the subscribers of the old company have had their instruments taken out and contracted with the new.

The long-distance telephone line between St. Cloud and Little Falls, Minn., will be completed about December 1st.

## Difficult Telephone Construction.

The successful construction of a copper metallic circuit telephone line between Leadville and Aspen, Colo., was announced in a brief newspaper paragraph the other day, but ten years ago the accomplishment of such a feat would have been telegraphed all over the world. The difficulties encountered in accomplishing long-distance telephoning in the state of Colorado are such as have not been overcome anywhere else, says G. P. Manning of Denver in the *Electrical Worker*. When the Colorado Telephone company first thought of extending its long-distance service from Denver to Leadville, it was a very grave question whether the enterprise would be successful, for the reason that the most available route was across Mosquito Pass, an elevation of over 13,000 feet above sea level, and at that altitude the elements are a constant menace to the maintenance of any overhead electrical construction. The engineers of the company, having had no experience to guide them in this matter, first thought that a line with 50 poles to the mile and of a very heavy copper wire might stand the strain, but the first storm of the winter following demonstrated that it could not possibly be kept up with that class of construction. The attempt was then made to accomplish the result by placing 59 poles to the mile and instead of copper wire to use No. 6 iron wire, which is generally used for guying poles, and is capable of standing immense strain. The result was no more satisfactory than the first construction, each storm breaking down the wires and poles, which it was unable to get at for days after the storm. The company was almost at its wit's end to know what to do. It was determined, however, not to be beaten in the game. A submarine cable, five miles in length, was constructed and laboriously hauled over the pass and placed under the ground in a trench 18 inches deep, which is very near bedrock. The experiment of submarine cable was demonstrated to be a success, and in the construction of the Aspen-Leadville line across Independence Pass, submarine cable has also been used. The telephone subscribers who now talk from Denver to Aspen will communicate with each other through five miles of submarine cable on Mosquito Pass and about four miles on Independence Pass. The line has been constructed according to the same specification as the long-distance line between New York and Chicago, and by the use of the improved long-distance transmitter talking is wonderfully distinct. The company has now in progress of construction another metallic circuit between Denver and Central City, by which

added facility the delay now sometimes occasional to patrons between Georgetown, Idaho Springs, Central City and Denver will be obviated. For the same reason a new copper metallic circuit is being constructed between Denver and Greeley. The long-distance system of the Colorado Telephone company now extends from Greeley to Fort Collins on the north, through Trinidad to Raton, New Mexico, on the south, taking in all the principal towns, and from Denver to Georgetown, Central City, Idaho Springs and other towns on the west in one direction, and from Denver to Leadville and Aspen to the west by another route. Men in Raton, New Mexico, for instance, can communicate with a correspondent at Aspen, about 350 miles apart.

## The Telephone as an Adjunct to the Postal System.

[From the *Chicago Chronicle*]

One of the tremendous strides in telephony in the near future is likely to be the substitution of the telephone for the mail bag. As a broad proposition it is claimed by telephone experts that the day is not far distant when business men and others will carry on conversations between cities and towns by wire instead of writing letters.

Radical as it may appear, it has been demonstrated that the telephone can be brought into such universal use as to practically curtail the mail service of the country, and at a cost for service not to exceed the present rate of postage. In other words, it is held that the present 2 cent postage rate applied to telephony will amply cover the cost of construction, maintenance and operation of telephone lines between all cities and towns in the United States, besides giving the public an infinitely better service than the slow-going mail methods.

It is learned from an unquestioned source of information that the forthcoming annual report of Postmaster-general Wilson to Congress will probably contain a recommendation for the appointment of a commission to thoroughly investigate the feasibility of adopting the telephone as an important adjunct to the mail service. Much data on the subject are already in the possession of Postmaster-general Wilson, and that official is said to favor a commission which shall be charged with the duty of making an exhaustive report on this subject.

To a Chicago man belongs the credit of having stirred up probable action by the federal postoffice authorities. While on an eastern business trip recently President J. E. Keelyn of the Western Telephone Construction company, whose headquarters are in Chicago, had several conferences with the postmaster-general regarding the practicability of government contracts for telephone service between certain points. The general idea, as discussed, was the possibility of making a cheap and popular rate between contiguous cities, where there is already a long-distance telephone service in operation.

At Postmaster-general Wilson's request President Keelyn, after his return to Chicago, put in writing some of the data obtained by the latter. This has been forwarded to Washington and will probably form the basis of an interesting recommendation from the postmaster-general in his forthcoming report.

It should be made clear at the outset that the proposed use of telephony as an adjunct of the mall service does not involve government ownership of either telegraph or telephone wires. This was insisted upon as a preliminary to taking up the subject at all.

If the government goes into the telephone business it will probably be on the same principle as it at present engages in the mail service, viz., the making of contracts with private corporations or carriers. In other words, the government will contract with telephone companies to handle public business the same as it contracts with railroad companies and coach lines to handle its mails. The government will sell stamps at a popular rate—say 2 cents for a single telephone message, or 5 cents for a message and return. The public will have the advantage of a uniform rate to all points, the same as letter postage, government contract being a guarantee of the efficiency of the service.

It is claimed that in the matter of expense the advantages will be all in favor of the telephone as against the handling of mails. By a system of minute calculations it has been demonstrated that the cost of manufacturing a postal card and hauling it between two long distance points is greater in proportion than the first cost of sending a telephone message between the same points.

The advantage to the public of bringing the cost of telephone messages down to the level of a postage stamp scarcely needs elaboration. It is claimed that it will revolutionize the whole business and social structure, just as the adoption of cheap postage brought the people closer together and the advent of railways and telephones ushered in a new commercial era.

It is a significant fact that the postoffice records show that the advent of long-distance telephony has already resulted in the falling off in the use of the mails between certain points. This is especially true where the cities affected are close together, and the telephone rate has not been made prohibitory by the Bell monopoly.

Between New York city and Elizabeth, N. J., for instance, there is now an inadequate long distance telephone service which nets the Bell monopoly about $15,000 per year at the rate of 25 to 35 cents per single message. Between the same points it is estimated that about 1,000 letters per day are carried each way. At the 2 cent rate this would be a gross revenue from the mail service of $40 per day or $14,600 per year.

The telephone service has grown, even at this high rate, while the mail service has steadily decreased. It has been estimated that the telephone cable between New York and Elizabeth cost about $10,000 and is capable of carrying 12,600 messages per day. The experts who have been assisting Postmaster-general Wilson have figured that if the cost of a telephone message between New York and Elizabeth should be reduced from 30 to 2 cents, or one-fifteenth, the business would become at least fifteen times as great. In other words the income from the present volume of high-priced messages would not be lowered at the cut rate, owing to increased business.

Between Chicago and Milwaukee the long-distance monopoly under the Bell system handles from 200 to 600 messages per day each way at the rate of 75 cents for day and 50 cents for night messages. Originally the tariff between Chicago and Milwaukee was only 40 cents, but the business increased so rapidly that the monopoly raised the rate to 75 cents to prevent the necessity of building other lines. It is the testimony of experts that the Chicago-Milwaukee long-distance line pays the entire cost of construction every 30 days the year round. One thousand messages both ways daily at 75 cents is $750 a day, or $22,500 a month. The line that handles this business does not represent an investment of much more than a single month's earnings.

Between Chicago and Evanston the rate of 15 cents per message represents an income to the long-distance company of about $50 per day, and the cost of maintenance is practically nothing. The operating service at both ends in the case of Milwaukee and Evanston and other intervening points is more than paid for by the local business done indirectly to the long-distance service.

These figures are given to substantiate the claim of the telephone experts that the enormous profits of the Bell monopoly are wholly based on the monopoly and not on the cost of the service. The charges could be reduced to all points to one-tenth or one-twentieth of present figures, and yet show a profit on investment.

One of the first results of the government's embarking in the telephone business would be to break down existing monopolies. Patents have expired, and, according to the experts, the field for competition is clear. On the strength of contracts with the government for a popular service at a nominal rate independent lines would be built everywhere.

The feasibility of cheap telephone service, under the auspices of the postal authorities, is to be worked out by a careful compilation of postal revenues between such points as New York and Washington, Philadelphia and Baltimore, Chicago and Milwaukee, and intervening cities. The cost of building and operating independent telephone lines between the same points to handle messages equivalent in volume to the mail matter will then be computed. The result, it is confidently expected, will permit the establishment of a 2 cent rate for telephone messages between the points named.

The growth of the system would naturally be gradual, and the introduction of the same nominal rate for longer distances would follow in time. The same rule of profit for short distances and loss for long distances that obtains in the postal service would doubtless permit in time a uniform nominal rate for the whole country.

In one of his recent letters to Postmaster-general Wilson on this subject President Keelyn wrote as follows:

"It may be fair to assume that at least 70 per cent. of the entire intercommunications will be done through the telephone or telegraph within 10 years. The comparative effect of this upon postal extension may, therefore, be considered of great importance.

"The great economy of telephone service, as well as its great advantage, should lead us to early take steps to meet its advances. It seems that the government could well afford to maintain inter-connecting lines between the principal large cities, in such manner that the tributary cities could reach those of any of the terminal points. We are getting to a point where the telegraph and telephone go hand in hand and where, at the present time, telephone messages and telegraph messages are handled over the same wires at the same time without interference."

## Chicago Electrical Houses to be Closed on Saturday Afternoons.

The following statement explains itself:

We, the undersigned electrical supply and machinery houses of Chicago, hereby agree to close our place of business at one o'clock on Saturday during the entire year, beginning with the first Saturday in November. This agreement to be binding only when signed by the Bradford Belting company, Central Electric company, Dearborn Electric company, Electric Appliance company, Metropolitan Electric company, Osburn Electric Supply company, the C. E. Woodruff company and the General Electric company.

METROPOLITAN ELECTRIC COMPANY,
Wm. H. McKinlock, President.
ELECTRIC APPLIANCE COMPANY,
Thos. I. Stacey, Secretary and Treasurer.
OSBURN ELECTRIC SUPPLY COMPANY,
M. Roy Osburn, Treasurer.
THE C. E. WOODRUFF COMPANY,
C. A. Woodruff.
CENTRAL ELECTRIC COMPANY,
Geo. A. McKinlock, President.
DEARBORN ELECTRIC COMPANY,
Charles Messer, Treasurer.
WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY.
J. T. Tebbetts, Manager Chicago Agency.
CHARLES E. GREGORY COMPANY,
A. Louis Kuehmsted, Treasurer.
BRADFORD BELTING COMPANY,
W. L. White.
GENERAL ELECTRIC COMPANY,
B. E. Sunny, Western Manager.
SIEMENS & HALSKE ELECTRIC COMPANY,
F. B. Badt, Secretary and Treasurer.

On November 12th the bids for the machinery for the electric light plant for the village of Mount Sterling, Ohio, were opened. Russell & Co. of Massillon, Ohio, were the successful bidders for the steam plant at $2,928, while the Fort Wayne Electric corporation secured the electrical plant by a bid of $3,133.42.

## Change in Rules Governing Sham Torpedo Fights.

A dispatch from Newport says that the rules governing sham attacks by torpedo boats have been slightly changed. The boat formerly had 2½ minutes after discovery to get within 400 yards of the object being attacked. This time has been cut down to two minutes. Two attacks were made by the Cushing on the night of November 12th upon the torpedo station under the changed rules, and it was found to be much fairer, the torpedo boat's chances being lessened. It was very dark, and the searchlight worked to perfection. Lieutenant Smith, in command of the Cushing, made his first attack in the open water. Having come in from Beaver Tail along the Connecticut shore, he turned sharply toward the east and ran straight on the torpedo station, the defense of which was in the hands of Lieutenant Hutchins and a class of seamen gunners. The Cushing was sighted far away, the pick-up of the craft being made at such a distance that she appeared to be merely a blur in the searchlight beam. Lieutenant Smith failed to get within 400 yards within the two minutes allowed him, and was therefore counted beaten. The Cushing won the second attack. In coming in from Beaver Tail Lieutenant Smith kept well in toward Connaicut, and did not come out till well up the bay. He was picked up, but not till he had crept in so far that he easily discharged his torpedoes within the 400-yard range before the expiration of the two minutes. By careful estimate the station search light in these tests was effective about 1½ miles away. The Cushing was followed this distance in its beam.

## American Superiority Recognized by German Engineers.

Hans Zopke, a German civil engineer commissioned by his government to look into the methods adopted in this country for the propulsion of cars by electricity, said to a Washington correspondent: "I think America is far ahead of any other country in the use of electricity. You have taken advantage of every invention and appliance that the minds of electricians have conceived, and in this are the leaders of the world. I have made many reports to my government regarding the electric roads of the United States, and now, as my leave is nearly up, I am furnishing the final recommendations and observations. I have been much interested in the experiments with electric locomotives, and the one used in Baltimore is one of the marvels of the age. It is a great credit to the General Electric company, and, I believe, is but the forerunner of greater things in the same line. I have applied for an extension of my leave in order that I may remain in the United States to see the developments of the next six months. I believe that the spring of 1896 will witness some of the greatest experiments with electricity the world has known. The principal trial will be in the use of electric motors on steam roads, and I feel sure that the results will be surprising. My government is much interested in the future of electricity, and is anxious to take advantage of all modern methods and appliances."

## Switzerland's Electric Wires.

The effect of telephonic facilities in this little republic has been to decrease the number of telegraphic dispatches 1.45 per cent., as shown by the report of the administration of mails and telegraphs for 1894. The statistics show that while the telephone service is a greater expense, the receipts are much larger. Thus the receipts in excess of expenses for telephones are 408,205.75 francs, and for telegraphs, 285,493.49 francs, making a gain in favor of telephones of 122,712.26 francs.

The length of electric conductors, including lighting and power lines, is distributed as follows in kilometers:

| | Lines. | Wires. |
|---|---|---|
| Telegraphs (government) | 7,203 | 20,092 |
| Telephones " | 7,844 | 41,153 |
| Railroads | 801 | 9,852 |
| Private lines | 592 | 928 |
| | 16,440 | 72,025 |

There are 1,649 public telegraph stations, a decrease of 219 offices, where telephone service has been substituted The subscriber pays for ordinary telephone service 100 francs for the first year, 70 francs for the second, and 40 francs per annum afterward, and five centimes for each local conversation.

## Electric Bicycle Lamps.

Various patents have been obtained for electric bicycle lamps. One is an ordinary primary battery, for which claims of lightness, simplicity and effectiveness are made; another employs a storage battery. A third proposal includes the use of a small dynamo on the machine. A copper coil is revolved between magnets, and the electricity passes to an incandescent lamp. Power is obtained from the front wheel of the bicycle. A small wheel is placed so as just to touch the tire on the inside of the rim of the bi-

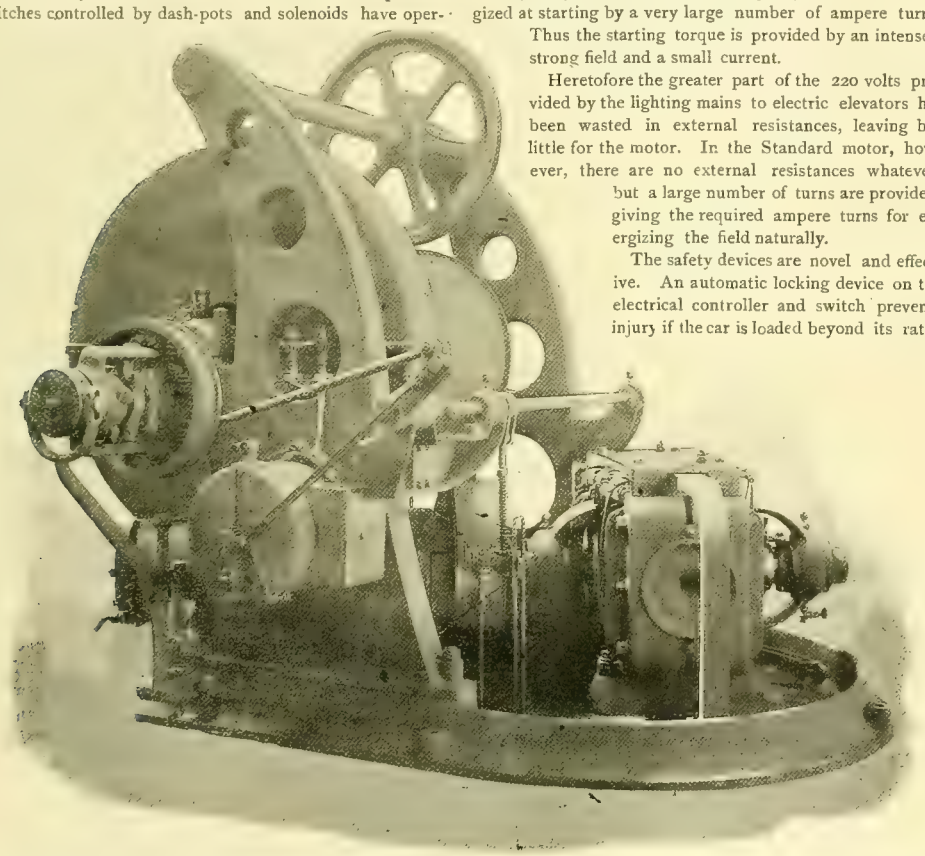
cycle wheel, the final plan not having been decided on. This small wheel will be connected with the dynamo at a gear of four or five to one. Of course the lamp burns only when the bicycle is in motion. It is believed that the whole outfit can be made to weigh not more than one pound and a half. Even at a slow pace enough electricity is generated to make a light, and the speed can be increased to 20 miles an hour without any result other than an increased brilliancy of the light. One objection seems to be the friction, although the inventor insists that it will be so slight as to be unnoticed by the rider. At any rate, one does not usually care to go far or fast at night, and the extra power required might not be a serious hindrance. The light, of course, would not be strong, but it might answer the purpose.

## Standard High Duty Electric Elevator.

The adaptability of electricity to all service where power is required was never so apparent as in its application to passenger elevators. The modern elevator is one of the essential features of civilized society. Not only is is indispensable to all office buildings, but it is now considered a necessity in all hotels, club houses and large residences. The many drawbacks of the hydraulic elevator, coupled with the great cost of installation and maintenance, have limited the field of the elevator up to date, but the success of the electric equipment seems destined to develop a field the extent of which has not yet been calculated.

The essential features of the electric elevator are high speed, absolute safety, complete control, applicability to the current from lighting mains, and low cost of operation and maintenance. All of these features are said to be combined in the new electric elevator recently placed on the market by the Standard Elevator & Manufacturing company of Chicago, which is shown by the illustration. The electric design is by Frank B. Rae, the well-known electrical engineer.

One of the reasons for the limited use of electricity in elevator work up to the present time is that elevator manufacturers have paid little or no attention to the design of the motor. In nearly all cases they have purchased an ordinary motor of some standard type from one of the electrical companies, and by the use of external resistance and complicated switches controlled by dash-pots and solenoids have operated a winding drum, with more or less success. This construction would lift the load, start and stop the car, but it is asserted to be highly inefficient as an elevator engine, and subject to the annoyances of stoppage, breakdowns, etc., inseparable from such a combination.



STANDARD HIGH DUTY ELECTRIC ELEVATOR.

The Standard electric elevator bids for public patronage on broad and interesting claims.

First—The operator has complete control of the car. He can move the car the entire distance of its travel at any speed, irrespective of its load. At the same time the design of the motor is such that he cannot damage things by carelessness or a willful manipulation of the controlling lever.

Second—The car starts immediately upon moving the lever, reaches maximum speed quickly and without jar. This is a eature of vital importance, as it enables the motor to assume a full load without the delay incident to other types of electric elevators.

Third—The car starts with its maximum load and secures a high average efficiency. As the percentage o total energy expended throughout the day in an electric elevator system is greater for starting the car from rest than in moving it at full speed, this is a matter of the first importance to the owner, who has the cost of operations to meet. The motor is so constructed that no external resistances, dash-pots or solenoids are necessary, the absence of which enables this high average efficiency to be obtained.

Fourth—The Standard elevator contains many new and important improvements in safety appliances for protecting the passengers against accident, and the motor from overload or obstruction. In this respect the elevator is the equal of any hydraulic elevator yet designed.

These claims being so comprehensive, it is interesting to know by what process Mr. Rae has obtained such an equipment.

The Standard elevators have long been favorably known to the public and are highly thought of wherever in use, so that the electrical power found a first-class mechanical outfit with which to combine.

The first objection to overcome was that offered by the companies supplying the current. It is well known that Edison companies have refused to permit more than 25 amperes of current at 220 volts to be drawn from their mains at any one instant, as a greater strain would seriously interfere with the lights. Heretofore this has been obviated by the operator waiting until, by the cutting out of resistances, the 50, 60 or 70 amperes necessary to start the load is introduced into the motor. This involves considerable delay, in addition to consuming a large amount of energy that in the Standard elevator is not required at all.

Mr. Rae solved this problem by designing a motor especially adapted for the work, that is, a motor having a field of very large magnetic carrying capacity that can be energized at starting by a very large number of ampere turns. Thus the starting torque is provided by an intensely strong field and a small current.

Heretofore the greater part of the 220 volts provided by the lighting mains to electric elevators has been wasted in external resistances, leaving but little for the motor. In the Standard motor, however, there are no external resistances whatever, but a large number of turns are provided, giving the required ampere turns for energizing the field naturally.

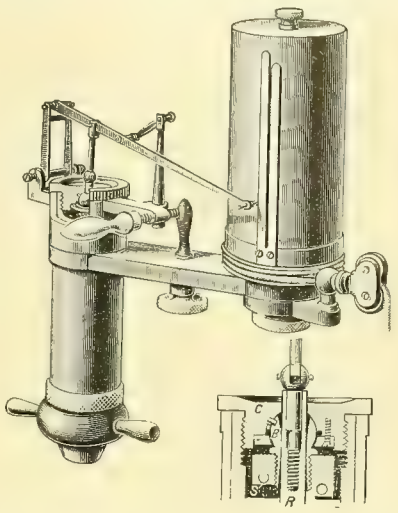
The safety devices are novel and effective. An automatic locking device on the electrical controller and switch prevents injury if the car is loaded beyond its rated capacity. Under this condition of overload it is imposible for the operator to increase the current, the locking device holding the switch at the position of maximum lifting capacity of motor. This permits a heavy load to be raised at slow speed with absolute safety.

In case of the car meeting with an obstruction when running at high speed, such as a tight place in the guides, the controller device will automatically diminish the speed and increase the power applied, so that when the obstruction is passed the car will again accelerate independent of, but under the control of, the operator.

Another valuable feature is that in case the current ceases, owing to interruption by stoppage of generating plant, or break in the supply conductors, the controller at once assumes the starting position independent of the operator, so that should the current be suddenly turned on again it finds the motor and appliances in condition to receive it without injury either electrically or mechanically.

## Robertson-Thompson Steam Engine Indicator.

In the steam engine indicator perfect accuracy is demanded. The worst enemy to correct practice is friction in the moving parts, and no instrument is considered worthy of confidence unless the piston and parallel motion will drop freely throughout the limits of their movement, without the slightest suspicion of a "catch." As this must be accomplished without appreciable lost motion in any joint, its attainment is only possible by design and workmanship of the highest order. To be assured that a slight friction will not be contributed by the final adjustment of the spring, it has been usual to provide some form of a "universal" or "ball and socket" joint for its attachment to the piston. Owing to the fact that this, as well as every other part subject to movement, must be constructed as light as possible, this ball joint has been made much smaller than considerations of lubrication and freedom from wear under the excessive pressure would indicate.



ROBERTSON-THOMPSON STEAM ENGINE INDICATOR.

To overcome this difficulty the arrangement shown in the accompanying cut has been devised. Briefly speaking, it consists in transferring the ball and socket joint from the piston to the cylinder head, where it has no movement, so that it can be made with a wearing surface probably 50 times greater than has been usual. As it requires no attention in changing springs, there are no adjusting screws which, sooner or later, will work loose while in operation and vitiate the diagram. The fact that it can be lubricated at frequent intervals while in use is also worthy of consideration. This device involves all the principles and has all the advantages claimed for the previous construction. It can be applied to any standard indicator at present on the market. It is manufactured by the Hine & Robertson company of New York.

## Electrically Operated Gatling Gun Fires 1,800 Shots a Minute.

The Naval Rapid Fire Gun Board, of which Lieutenant N. E. Mason is the senior member, has submitted to Captain Samson, chief of the bureau of ordnance, a report on the trial of an improved Gatling gun. A novel electrical attachment is used with the gun, which permits of about 1,800 shots a minute being fired—a remarkable showing. The motor is attached to the breech of the gun-casing by an interrupted screw. The electric current is regulated by a switch, and the connection with the firing mechanism made and broken by a push-button held in the gunner's hand. The weight of the motor and casing is 106 pounds; the length, 21⅜ inches. The additional length of the gun when the motor is attached is 20 inches. The projection of the central shaft from the breech when the motor is unshipped is 2 7/16 inches. As stated, with the motor in operation, the gun can fire 1,800 shots a minute. The board says that several hundred shots were fired, the only interruption being due to temporary jams in the gun or feed strips, and that the action of the motor was smooth and regular throughout.

W. L. Primm, formerly of Chicago, has established an electric light plant at Galena, Ill. The recent opening was attended by the mayor and other prominent citizens, who expressed much satisfaction at the great improvement in the lighting of the city. The Brush system is used.

## A Few Corrections Necessary.

Accuracy is the foundation stone of all valuable journalistic endeavor. This is especially true of technical journals, which essay the role of specialists in the journalistic survey of the arts and sciences. Josh Billings, in one of his philosophical deliverances, asserted that he preferred to say few things rather than so much that wasn't so, and he was wise. But it is difficult to sift the kernels of truth from the chaff of exaggeration and misstatement that beclouds scientific and industrial advancement. The exercise of this discrimination is one of the principal functions of the technical journalist. But lapses do occur, and the *Railroad Gazette* calls attention to a recent striking instance:

One of the electrical journals says that the Grand Trunk is about to adopt the electric locomotive for the tunnel service under the Detroit river at Port Huron. We are informed by that journal that the locomotives now working the tunnel weigh 95 tons and have eight drivers; that the "cut through the rock is lined with steel with a backing of a peculiar kind of asphalt;" that the steam and the excessive heat from the locomotives have such an effect on this backing that it is rapidly deteriorating and that in other ways the locomotives are injuring the tunnel structure; hence the determination to use electric locomotives. With a few corrections this item will pass. The tunnel is not under the Detroit river, but under the St. Clair river. The locomotives now used have not eight drivers, but 10, and they weigh in working order 195,000 pounds, all on the drivers. The tunnel is not lined with steel, but with cast iron. The backing of the lining is not asphalt, but Portland cement grout. No injurious effect has been produced upon this lining by the steam or heat from the locomotives. And finally, the main proposition is not true; the Grand Trunk is not about to about to adopt electric locomotives for this service.

## Attitude of Steam Railroad Companies Toward Electric Traction.

In concluding an article on the development of electric traction on steam lines, the *Railway Review* advances the opinion that the turn which will probably be taken in electric traction is for the steam lines to continue to equip with electric motive power for suburban service, or to secure and develop the property of the existing electric lines. This line of progress is being followed by one of the most prominent eastern roads.

The twenty-fourth annual report of the New York, New Haven & Hartford railroad speaks well for the economy and in other respects satisfactory results of the Nantasket experiment. It says:

The experiment has demonstrated that power generated in a stationary plant and transmitted by electrical agency can be successfully used in the operation of a standard railroad. The current expenses for fuel indicate that this result is economically obtained. Power thus transmitted is capable of indefinite subdivision, and is, therefore, most available for frequent car service. The commercial result depends only on the durability of electrical equipment. The use of the existing power station will be extended presently, and it is probable that electricity will be promptly adopted by the company at other points on its lines. With a road free from grade crossings, it is not too much to expect its ultimate application wherever the business justifies a frequent train service, and it is to be hoped without the use of an overhead trolley.

## Rohl-Smith Statue of Franklin Going to Pieces.

Visitors to the World's Fair cannot fail to remember the great statue of Franklin by Carl Rohl-Smith, the sculptor, which was such a prominent feature of the hemicycle of the electricity building. At the close of the exposition the figure was removed to Philadelphia. The *Record* of that city reports that it was placed on the campus of the University of Pennsylvania. It had been intended to place it in the university library in honor of the founder, but it was discovered that the piece was much too large to be erected in the library, and it was placed on the campus after the staff of which it was composed had been coated with a preparation to prevent its decay. It withstood successfully one winter season, but the summer's heat decayed it throughout. First the kite, which was greatly prized, was lost, and now the head is gone.

## Power Transmission Plant at Portland, Ore.

The information furnished by the General Electric company regarding the power transmission plant at Portland, Ore., which was illustrated and described in this journal October 12th, was erroneous in one particular. The assertion is made in the article that "the four-wire system is worked at 1 000 volts between wires and by means of feeder regulators a variation of 4 per cent. in either direction is covered." This should read, "The four-wire system is worked at 133 volts between any two wires and by means of feeder regulators a variation of 7½ in either direction is covered."

# CORRESPONDENCE.

## New York Notes.

NEW YORK, November 16.—Nearly all of the lower part of the city—from Forty-second street to the Battery—was in darkness last night. It was due to an accident in the works of the Brush Electric Light company. The seriousness of the matter was at once apparent to Mr. Conlin, acting chief of police, who summoned all the precinct commanders to police headquarters, and gave orders that the patrolmen exercise unusual vigilance. The accident was caused by the bursting of one of the main pipes in the boiler room of the electric light plant. Three men narrowly escaped scalding to death. Repairs were made as quickly as possible.

Foreclosure proceedings have been brought in the United States Circuit Court, Eastern District of Virginia, by F. Kingsbury Curtis, representing the New York Guaranty & Indemnity company, against the Long Island Traction company, the Brooklyn Heights Railroad company and Horace J. Morse as receiver. F. Kingsbury Curtis, a special master appointed by the United States courts, will offer at public sale at No. 111 Broadway, on December 5th next, the rights, franchises and property owned by the Long Island Traction company and the interest it owns in the capital stock of the Brooklyn Heights and the Brooklyn, Queens County and Suburban Railroad companies, together with all assets receivable by the Brooklyn Heights company under the lease of February 14, 1893, and all the interest of the Traction company in a certain guarantee fund of $4,000 000 mentioned in the lease.

The managers of the elevated roads in New York and Brooklyn seem to have adopted the policy of going to the utmost limit of procrastination in getting at the inevitable substitution of electrically transmitted power for steam locomotives. They do not pretend to deny that the electrical method is superior and cheaper in the end; they know that the public desires the change, but they are loth to discard their expensive locomotives and undertake to make the improvement. They are conservative to the verge of timidity and would be greatly benefited by an injection of Chicago enterprise. In a recent interview, O. F. Nichols, the chief engineer of the Brooklyn company, says that he knows of no electrical system that supplies exactly what they want in that city, but he neglects to specify what they do want. Mr. Nichols makes the statement that the overhead road in Liverpool is the only successful electrical elevated railroad that he knows of, but does not state wherein the Metropolitan system of Chicago is unsuccessful. His whole interview bears the impress of a desire to pettifog the issue and to put it off as long as possible. Mr. Nichols is careful, however, not to take a decided stand against the use of electrical power. "I am not antagonistic to the use of electricity for such purposes," he says. "I am only conservative, as the company is. I take a great interest in the problem, and should welcome a profitable change of power. No; I don't care to say which of the present systems I prefer. Perhaps the Westinghouse system is operated a little more cheaply than the others on surface roads, judging from the results shown on the De Kalb avenue line. The matter has been talked of by our officers lately only in a general way. We have had propositions made to us that we should permit our road to be equipped with an electric system, the proposers bearing the expense, with the provision that if the system was operated cheaply and satisfactorily for a year we should accept it. There have been two men within a year who have come to us with plans and systems. We gave them a respectful hearing, but the matter has not gone much beyond that. We shall watch the proposed experiment on the bridge with interest, as it may contain some useful points for us. We operate about 20 miles, the Kings County company about 10. If the company were paying dividends it might be more disposed to take risks. But if it became advisable to make the change of power the company would be financially able to do it. It prefers that some other road shall make the experiment, however."

There is some comment in Paterson on the fact that the New Jersey Electric Railway company paid only half cash for the November interest on its bonds and gave scrip for the balance. The scrip is redeemable in either cash or bonds six months hence, and on that date bonds are to be issued in payment of the May interest. This system extends from Singac, Passaic county, through Paterson to Clifton, Passaic, Rutherford, Carlstadt and across the meadows to Union Hill and Hoboken, where it connects with the North Hudson county lines to the ferries. It is a consolidation of several roads projected by James A. Morrisse of Paterson and backed by New York capitalists chiefly; but there are a considerable number of small stockholders in Paterson. The capital stock is $2,400,000 and the bonded debt is stated to be $2,360,000. The bonds were given as a bonus to stock subscribers. Large sums have been spent in improvements, including rolling stock and large carhouses at several points. The section from Rutherford to Hoboken was only completed and put into operation during the last summer. The officers elected last month are: John L. Heins, president; Thomas D. Jordan, vice-president and treasurer; John J. Scanlan, secretary; James A. Morrisse (chairman), William H. McIntyre, Thomas D. Jordan, John L. Heins, executive committee. Mr. Morrisse denies that the road is in danger of bankruptcy. He says that the part from Singac to Rutherford is paying both running expenses and interest charges, and that the Rutherford-Hoboken end meets operating expenses.

The Metropolitan Traction company has at length succeeded in securing control of the Eighth avenue railroad by means of a 99 years' lease at a guaranteed interest of 15 per cent. on the entire stock. With the exception of the Third avenue and the Madison avenue lines the Metropolitan company has finally added unto itself all the main surface railways of the city. It has gradually absorbed crosstown and north and south lines. The Eighth avenue line has long been an object of its desire. It is reported that Mr. Law finally consented even to the 15 per cent. annual payment only under extreme pressure.

W. F. O.

## Milwaukee, Wis.

MILWAUKEE, November 16.—The long squabble over the electric lighting contract has been settled at last and the city will not build a lighting plant of its own for some years to come. The Badger Illuminating company, which is simply a branch of the Milwaukee Street Railway company, has again got the contract for lighting the streets of the city. The contract is for a term of five years and the price is $109 a lamp a year for lamps located on an underground conduit within two miles of the center of the city and $92 a lamp a year for lamps located on overhead conduits or on underground conduits outside of the two-mile circuit. There are about 100 lamps fed by underground circuits outside of this district. The city, under the new contract, will pay within $1 a lamp as much as it did last year for underground service, but it will pay very much less—$18 a lamp—for overhead service, as the uniform rate under the old contract was $110 a lamp a year. There is a provision in the new contract by which the city, by giving due notice, may purchase the company's lighting plant, the price to be agreed upon by arbitration. The Common Council, having recognized overhead service, will now have to repeal the ordinance passed a number of years ago compelling the Badger Illuminating company and all companies using electric wires on public thoroughfares to bury their wires at a certain rate each year. The council was very firm on this question until the question of erecting a municipal lighting plant came up and then there was a great deal of talk of the city's giving itself overhead service in the outlying districts. Hereafter wires will probably be buried in the business district only.

An attempt was made to set aside the deal by which the Milwaukee Street Railway company or its representatives acquired the stock of the Milwaukee Arc Light company and thus prevented competition in the city lighting matter. An examination was held before Court Commissioner McElroy, but nothing of importance was elicited, and the whole proceeding has fallen through. It developed at the examination that Dr. W. H. Earles and W. J. Fiebrantz had obtained control of the Milwaukee Arc Light company stock and had transferred it to Charles F. Pfister. The consideration was $100,000, of which $55 000 was to be in cash, $25,000 in stock in a new company and the balance a mortgage assumed by him. The contract itself was very carefully guarded. The attorney for Mr. Pfister requested the other attorneys to read the contract quietly and not to allow the reporters to get any inkling of its contents. Even the official stenographer was not permitted to glance at the document. Gustav Wenninger, the plaintiff, alleged that Earles and Fiebrantz acted as his agents in the sale of the stock, while they had set up that they had purchased the stock outright. The sum to be paid to him, Mr. Wenninger asserted, was 100 cents on the dollar, but only 75 cents on the dollar was offered to him. Mr. Pfister said that he had purchased the property in the interests of other persons and that the stock had been deposited with F. G. Bigelow as trustee. Messrs. Bigelow and Pfister are both directors of the Milwaukee Street Railway company. Mr Pfister said that the first payment, amounting to $25,000, had been paid upon the contract, and that the second payment was due within a day or two. Fiebrantz testified that Wenninger had owned 546 shares of stock in the Milwaukee Arc Light company and that he, Fiebrantz, had obtained an option of the stock which he had

transferred to Dr. Earles. The consideration for Wenninger's shares, according to the option, was $9,000. Dr. Earles said that the option in question was in the possession of his attorneys and that only $25,000 had been paid upon the contract for the sale of the Milwaukee Arc Light plant. At this point the examination ended very abruptly and nothing has since been heard of the matter.

Ex-Congressman McGann of Chicago and his associates, who incorporated the Milwaukee General Electric Railway company, have virtually been granted a franchise by the Common Council. Whether they have won a victory over the Milwaukee Street Railway company, is another question. The committee on railroads had the matter under consideration for a long time, and when finally agreed upon a report, it was with so much unanimity that nobody was able to understand just what it meant. It was the first time that Alderman Frederick Kuth, the chairman of the committee and the stout champion of the Milwaukee Street Railway company, and Alderman George Thuering, the most determined enemy in the Common Council of the corporation which Kuth defends so faithfully, had ever agreed upon a street railway measure that might injure vested rights and interests. Everybody was surprised. The committee, it was learned, decided to impose several new conditions upon the company. It will be required to put down all pavement between its tracks for a period of five years and to keep the pavement in repair. Thus, if a pavement is renewed or a different pavement laid, the company will have to stand the expense of improving the portion of the pavement between its tracks. The company will also be required to strengthen the south approach as well as the north approach to the Sixth street viaduct, over which it proposes to build a line. A bond in the sum of $50,000 for the express purpose of indemnifying the city for the loss of claims for damages for personal injuries to anybody at crossings, etc., is also demanded by the committee. The proposition to sell six tickets for 25 cents was allowed to stand. P. J. Somers, representing the Milwaukee General Electric Railway company, said that so far as he knew the provisions made by the committee would be satisfactory to his company. The route for the line has not yet been accepted and the report has not been made to the council. Alderman Thuering was of the opinion that by the time that the ordinance was presented to the council, Chairman Kuth would have ready a report against granting a franchise to the new company. At present the situation is so peculiar that one has no idea of what is going to happen next.

The city officials and the street railway people have just had a lively little spat. The city has raised the grade of State street two inches and asked the railway company to stand the expense of paving the portion of the street between its tracks with cedar blocks, with which the rest of the street was being paved. The company is required to keep the portion of the street between its tracks in repair, but it at first refused to put down new pavement at its own expense. The commissioners of public works insisted that the company was morally bound to put down the pavement and the management was severely criticised for its unwillingness to do the work. City Engineer Benzenberg went so far as to declare that in the future the city ought to build tracks for street cars wherever they were needed and lease them to the street railway company or companies. Finally the city officials called upon Charles F. Pfister, one of the street railway directors, and laid the matter before him, with the result that the company agreed to do the paving. The city attorney had decided that the provision requiring the company to repair the pavement did not oblige it to put down new pavement between its tracks.

C.

## New England News.

BOSTON, November 15.—The Boston Electric Light company and the Edison Electric Light company were petitioners before the Board of Aldermen recently and asked for a hearing on the council resolution which recommends the establishment of a municipal electric light plant for the city of Boston. The order as it came from the city council is as follows:

*Resolved*, That in the opinion of the city council of the city of Boston and in accordance with the provisions of chapter 370 of the Acts of 1891, and chapter 454 of the Acts of 1893, it is expedient to exercise the authority conferred by section 1 of said chapter 370 of the Acts of 1891, entitled "An Act to Enable Cities and Towns to Manufacture and Distribute Gas and Electricity."

*Resolved*, That, in the opinion of the city council, the city of Boston should not pay more than $74 per arc per year for its electric lighting, pending the establishment of a municipal electric light plant.

*Resolved*, That, in the opinion of the city council of the city of Boston, the establishment of a municipal electric light plant will result in a great saving to the taxpayers; therefore be it

*Ordered*, That His Honor the mayor be requested to petition the General Court at the next session for the passage of an act that will enable the city of Boston to secure, at the earliest possible date, its electric lighting at a minimum cost.

The report of the committee, which was appointed some time ago by the lower branch of the city government, and which is responsible for the above resolution, is being criticized in various quarters. The committee overlooked in its estimate the liability of the city for damages to persons injured by the wires, and it is conceded that the expense of the electric light companies in defending suits, even those in which it is ultimately successful, is a large item to be considered in estimating cost of production. In a recent case against one of the large companies in Boston the company expended over $2,300, exclusive of counsel and witness fees, although it had no damage to pay to the plaintiff at the end. The committee's estimate is also for an overhead system, while under the laws of the commonwealth the wires must go underground. In putting its wires underground the Boston Electric Light company has already expended $300,000 and estimates that the entire cost of doing this will be $900,000. On the question of average cost under existing conditions Boston pays per hour per light 3.30 cents, while the average cost in the country, from reports from 2,000 electric light companies, furnishing 300,000 street lights, is, per hour, 3.57 cents. It is unquestioned that the cost in Boston for state taxes, coal and water are higher than in other cities of the same size. It is also true that in some of the cities where the committee reports lower prices for lights, the company makes its light by water power, and practically saves the important item of fuel. In this connection it may be said that the committee's estimate for building a 3,000-arc plant is $750,000, but in January, 1893, an estimate was submitted to the city council, prepared by City Engineer Jackson, which put the cost for a plant with one station, and not including real estate, at $1,286,320, while another estimate, submitted at the same time by Stone & Webster, electrical engineers, for a plant with duplicate stations, and not including real estate, placed the sum necessary at $1,549,200. In both estimates overhead wires were contemplated.

The West End company is about to equip one of the four remaining routes which are now operated by horses with electricity. This is a route which runs into the city from Somerville and is really the only one of consequence which is not already equipped with the trolley system. It is about five miles long. There are two routes running through the Back Bay, the swell residential section of the city, where horses are now used, and there is also another short route along the water front, between the northern and southern depots, which is operated by horses. Of the 1,050 street cars now in use by the West End road less than 50 are drawn by horses, including the Somerville line.

C. S. G.

## PERSONAL.

Elmer A. Sperry of Cleveland has been in Chicago several days.

Ralph W. Gordon, representing the Gordon-Burnham Battery company of New York, is in Chicago.

Mr. and Mrs. George A. McKinlock of Chicago were among the out-of-town visitors at the Horse Show in New York last week.

George Warren Furbeck has been appointed general southwestern agent for the Siemens & Halske Electric company of America and the Eastern Electric Cable company, with office in the Bank of Commerce building, St. Louis, Mo.

## ELECTRIC LIGHTING.

The Knoxville, Tenn., Electric Light & Power company will install additional engines and arc dynamos as soon as possible to meet an increased demand for light from the city and private customers

The Chicago Edison company has connected its North and South Side systems by a cable laid in the bottom of the Chicago river at State street. The cable is not sufficiently large to carry the entire North Side load, except during the lightest time of the day. It contains two wires of 1,000,000 circular mils each, together with neutral and pressure wires. The whole cable is 388 feet long and is laid in a trench in the bottom of the river, 22 feet below the surface of the water. The cable is of the best quality of submarine work and thoroughly armored.

## ELECTRIC RAILWAYS.

A press dispatch from Youngstown, O., states that Senator Brice has purchased the controlling interest in the Youngstown Park and Falls street railway. The road is to run to the Lima coalfields, thence to the falls. It is intended to haul large quantities of coal to the city, and large tracts of valuable coal lands are included in the purchase.

Canadian capitalists are interesting themselves in the project of an electric street railway in Buenos Ayres, Argentine Republic. The city has 750,000 inhabitants, and there are only two streets in which the electric company has not the right to lay down tracks. The matter has been brought to the attention of capitalists by J. Arthur Maguire, consul-general at Quebec for the Argentine Republic, and several men of wealth are joining the promoters of the Buenos Ayres railway.

## TRADE NEWS.

The Kester Electric Manufacturing company of Buffalo claims to have, in its soldering compound, the best article of its kind for soldering electrical work of every description.

The Missouri Electric Repair company of St. Louis reports the sale of Colburn dynamos and arc lamps to the Wear-Boogher Dry Goods company and the Lindell Hotel in that city. These orders included the construction work on both plants.

*Electric Power* proposes to issue an annual "Synopsis of Current Electrical Literature," in book form, compiled from the synopsis which appears regularly in the magazine. There is need of just such a record of periodical electrical literature in permanent library form, and as the editor, Mr. Osterberg, has demonstrated the necessary discrimination and impartiality for the task, the venture deserves success.

The Graham Equipment company of Boston, Mass., manufacturer of the beam truck, reports that it is at present driven to the utmost capacity of the works to fill orders. The extensive exhibit of this concern at the Montreal convention, under the supervision of President J. H. Graham, has resulted in a large number of orders for trucks.

A neat catalogue is issued by the American Tool & Machine company of Boston, Mass., containing some pointed announcements regarding its facilities for taking up a line of jobbing work for which it is especially well equipped. The new trademark is of unique design, and tastefully displayed upon the booklet. This company has been exceedingly busy of late, and Assistant General Manager M. M. Whipple reports that the indications are for a much larger business for this year than ever before. The strong personality of the company has had much to do with its success.

The equipment of the model electric light and power station recently erected by the city of Hamilton, O., has called forth much praise from electrical engineers and others who have visited the plant and inspected the machinery there installed. The *Hamilton Daily Republican* in an exhaustive description of the establishment calls particular attention to the Root improved water-tube boilers employed (there is a battery of two of these boilers, each of 208 horse power) and says: "The electric light committee is to be congratulated upon their selection of these boilers for the city's new electric light plant. In so doing they have acted in accordance with the judgment of the best engineers of the city."

The Triumph Electric company of Cincinnati, Ohio, announces that it has bought the entire plant, including all patents, formerly belonging to the Waddell-Entz company of Bridgeport, Conn., and is now moving this plant to Cincinnati, where it will be added to the present equipment, giving the Triumph company one of the largest and best equipped plants in this line in the West. The former Waddell-Entz machines were well and favorably known and universally acknowledged as essentially high grade machines. The same excellence of detail and design will be adhered to, embodying such improvements as experience has suggested. The reputation of the Triumph company for high grade work is a guarantee in itself that nothing else will leave its hands, and it is hoped that those who have desired information concerning this machine in the past, and been unable to get it, will note that it is again on the market. Any correspondence addressed to Manager J. C. Hobart on the subject will have prompt and careful attention. The company will not discontinue manufacturing from any of the present Triumph patterns, the many popular features of which have been so well demonstrated. It will be its aim in the future as in the past to give prompt and careful attention to anything entrusted to it.

In describing the power plant of the Niagara Falls Hydraulic Power & Manufacturing company the *Canadian Journal of Commerce* says: "The four wheels for this plant are being built by the James Leffel & Co. of Springfield, Ohio, under general plans and specifications made by the engineer of the Niagara Falls Hydraulic Power & Manufacturing company. Three of these turbines are specified to generate each 1,700 horse power under a head of 205 feet, which is the minimum head estimated as obtainable, and to run at a speed of 250 revolutions per minute. As the ordinary head will be from 210 to 215 feet, the power of these wheels will be from 1,800 to 2,000 horse powers each. * * * * The James Leffel & Co., who make a specialty of high grade turbines for high heads and heavy duty, supplied the Cliff Paper company at Niagara Falls about four years ago with two horizontal turbines of substantially this same design, each of which, under 125 feet, develops 1,200 horse power of a speed of 220 revolutions per minute. * * * * This plant, which is located adjacent to the proposed new plant, has proved successful in all its details. It embraces several new and important features which had not been attempted before in turbine construction, all of which, with other new and valuable improvements, will be embodied in the new turbines."

## BUSINESS.

The Connecticut Telephone & Electric company of Meriden, Conn., has a complete line of telephone outfits, and is prepared to furnish instruments of all grades, from the simplest to those capable of the most exacting service.

The Consolidated Wholesale Supply company, 209 to

219 South Clinton street, Chicago, manufacturer and wholesale dealer in all kinds of merchandise for merchants, agents and farmers, announces that it is examining samples and selecting goods for a catalogue soon to be issued.

The Porter Standard Motor company of 68 Broad street, New York, has just issued catalogue No. 5 of motors, dynamos, batteries and electrical supplies. Scientific and mechanical exactness is claimed, and a specialty is made of small motors designed to be driven by battery currents.

As an indication of the fact that Paranite wire is rapidly growing in popular favor, the Electric Appliance company, Chicago, states that although the factory is running full force night and day it is having great difficulty in keeping even with its orders. It is turning out more rubber-covered wire now than at any previous time in the history of the business

The Racine Boat Manufacturing company has just closed a contract with a Chicago gentleman for a steel steam pleasure yacht costing about $75,000. The yacht will be equipped with all modern conveniences, and is to be built this winter and ready for spring delivery. This contract will necessitate putting in some special tools for this work and the purchase of considerable material.

The new office of the American Circular Loom company, recently opened by H. H. Brooks and A. D. Chandler in the Marquette, Chicago, reports an excellent business and prospects encouraging. Messrs. Brooks & Chandler certainly deserve success for their progressive policy, and it will be gratifying to their many friends to note that the move in establishing a western office is already bringing in fine returns. In this connection it is interesting to note that the American Circular Loom company has recently completed an excellent piece of work in the government insane asylum in the District of Columbia. The electrical plant in this asylum is constructed of strictly first-class material. It is wired with Kerite, and American Circular Loom conduit is used.

Amongst the recent installations of underground wires in Chicago, the work now about completed by the Standard Underground Cable company for the Postal Telegraph-cable company, in providing the necessary underground wires for the latter company's contemplated removal to the Stock Exchange building, is particularly noticeable. The facilities necessary for this important work required several miles of 126-wire, lead-covered, fiber-insulated cables of unusually large size. These enormous cables were successfully drawn into cement-lined conduits provided by the National Conduit Manufacturing company. Their extreme size and weight required particular methods and special apparatus for the purpose of drawing them through the ducts, and a large force of skilled workmen was necessary to do the work. Some idea of the size of these cables may be had when it is stated that the joints and branches required a lead pipe of four inches in diameter to cover them. The successful completion of this work reflects great credit upon the Standard Underground Cable company and its Chicago management which is in the hands of J. R. Wiley, with F. S. Vielé as superintendent of construction.

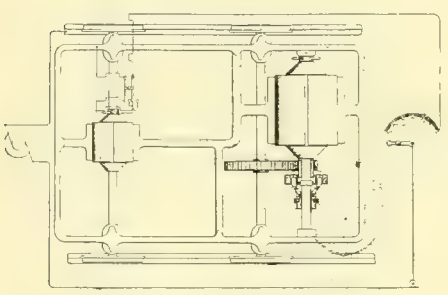
# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued November 12, 1895.*

549,485. Electric Locomotive. Francis B. Badt, Chicago, Ill. Application filed August 1, 1895.

The arrangement is shown in the cut, and this claim is made: In an electrically propelled vehicle the combination with a plurality of speed motors, each mounted directly upon an axle of the vehicle, of a plurality of starting motors connected with the axles through intermediate gearing, a clutch for each of said starting motors, means for simultaneously connecting or disconnecting the starting motors, means for connecting the starting motors in circuit, and means for subsequently connecting the speed motors in circuit and for disconnecting the starting motors from the circuit.

549,491. Railway Telephone System. William H. Clewley, Providence, R. I. Application filed April 10, 1895.



NO. 549,485.

A system of wiring for electrical communication is described, which consists of two parallel conductors, each normally electrically open in one direction but at opposite ends of the system, means at various points along the conductors by which an instrument for electrical communication may be inserted between them, an electrical connection between the other ends of the conductors, one or more instruments for electrical communication inserted in the electrical connection, and means for electrically connecting one or both of the conductors at its normally open end with the other of the conductors.

549,501. Electric Shunting Device. Augustus B. Depuy, Camden, N. J. Application filed March 19, 1895.

The device comprises a galvanoscope, having fixed to the axis of the needle a cam situated between two flat contact springs, the springs being connected respectively, one with the coil of the galvanoscope and the other with the ground.

549,502. Dynamo Brush. James Dickson and Robert G. Shapcott, London, Eng. Application filed July 7, 1893.

Plaited and compressed wires are inclosed in the wire gauze jacket, having its outer edges secured by wire stitches, and its ends covered by the securing cap.

549,522. Electric Motor System and Traction Device. Thomas P. Milligan, South Orange, N. J. Application filed January 26, 1895.

A single rail, a motor for supporting wheels which rest on the rail, driving wheels on each side of the web of the rail which are positively driven by the motor, and means to permanently and independently press each of the driving wheels against the rail.

549,542. Electric Elevator. Humphrey R. Smith, Chicago, Ill. Application filed March 4, 1895.

Features included in the invention are a car, an electric motor, an electric switching device arranged in the motor circuit, a circuit for controlling said switching device, and means carried by the car for varying the current in said switch-controlling circuit.

549,556. Automatic Electric Cut-off. Clinton E. Whitney, New York, N. Y. Application filed January 2, 1895.

In this mechanism there are a casing, a dial, clock works in the casing, an hour hand whose hub carries a stud, an indicator and a setting wheel, a wheel on a shaft, and engaging wheel for setting the indicator, contacts and wires adapted to put the time mechanism in electric circuit with a battery and auxiliary mechanism.

549,577. Arc Lamp Globe Holder. Gilbert L. Moyer, Hartford, Conn. Application filed March 19, 1895.

In combination with the frame of an arc lamp there are brackets with guiding openings through one edge of the upper plates, and guiding openings through the opposite edge of the lower plates, a movable globe holder, and connections between the brackets and the globe holder.

549,597. Combined Rheostat and Reversing Switch for Electric Motors. Jonathan P. B. Fiske, Alliance, O. Application filed November 6, 1894.

A frame and a tray secured thereto, a resistance coil retained in position by the tray, and having its convolutions insulated from each other, and a contact device adapted to be passed transversely over the convolutions to include more or less of the resistance coil in an electric circuit, are the chief parts of the device.

549,598. Electric Controller. Jonathan P. B. Fiske, Alliance, O. Application filed February 13, 1895.

A flat coil of resistance material having insulation between its convolutions is used; also two sets of contact plates disposed parallel with one face of the coil, connections between both sets of contacts and the convolutions of the coil, and a contact device constructed and adapted to be moved over either set of contact plates.

549,608. Electric Controller. William H. Morgan, Alliance, O. Application filed August 22, 1895.

A frame for an electric controller, consisting of two open castings secured together so as to form a shell or casing, having elongated openings in its sides or edges, and wire netting in said elongated openings.

549,621. Controller for Electric Motors. Merle J. Wightman and Oscar Urban, Scranton, Pa. Application filed February 6, 1895.

Two electric motors are employed with their multiple series controller, a switch and connections whereby the motors may be run in multiple, each with its own controller resistance or other means for governing its operation.

549,636. Electrical Steering Gear. George S. Grimston and Alfred H. Dykes, London, Eng. Application filed April 9, 1895.

Two electro-magnetic clutches, each adapted for coupling with the screw gearing, a prime motor operating the clutches, and screws to turn the rudder to starboard or port as determined by the clutch, for the time being engaged with the motor and screw gearing, and a source of electric energy in circuit for magnetizing either clutch are employed.

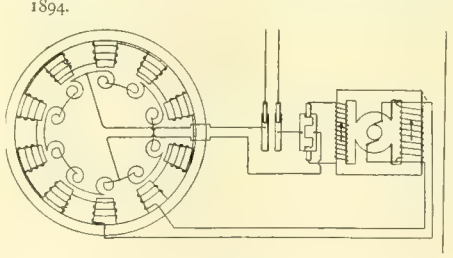
549,644. Regulation of Alternating Generators. Francis P. Ide, Eau Claire, Wis. Application filed April 6, 1895.

The method employed of regulating the potential of an alternating current generator consists in energizing the field thereof by means of a continuous or direct current supplied by an exciter, rectifying the current produced by the generator, and then through the agency of the rectified current variably shunting lines of force around the armature, thereby effecting the reduction of the strength of the field for small loads and the increase of the strength for larger loads.

549,649. Storage Battery. Morris Moskowitz, Newark, N. J. Application filed April 20, 1895.

A storage battery is described, comprising a cell, shallow cups or pans open at the top, a metallic ring or frame in each cup or pan, an active material firmly secured in each ring, whereby the same is removably arranged with the rings in the cups or pans, connections with the rings or frames, and means between the cups or pans for separating them and exposing the surface of the active material directly to the action of the acid in the battery.

549,652. Underground Electric Propulsion. John E. Parker, New York, N. Y. Application filed June 23, 1894.



NO. 549,644.

A rectangular metal slotted conduit, having a continuous flange or flanges on the base thereof, and a removable cover in which the slot is formed, in combination with the removable iron cross frame adapted to support the underground conductor and the removable cover, are the essential features of the invention.

549,655. Contact Device for Electric Railways. Constantin A. Philipsborn, Berlin, Germany. Application filed April 20, 1893.

Two independent laterally extended contact surfaces are adapted to respective line conductors, and means connecting the contact surfaces to the vehicle, and permitting their bodily movement both longitudinally and transversely of the conductors are employed.

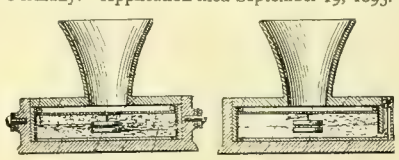
549,663. Carbon Brush Holder. George H. White, Chicago, Ill. Application filed August 5, 1895.

There are a clamp having a flat surface, against which the carbon brush or block is adapted to be fixedly clamped, a holder upon which the clamp is mounted, and a resilient connection between the clamp and the holder, permitting the longitudinal movement of the clamp, and also a rocking movement forward and backward in the plane of the commutator.

549,709. Multiple Telegraphy. Thomas B. Dixon, Henderson, Ky. Application filed September 12, 1895.

One of the claims follows: In a system of multiple telegraphy the combination with a line conductor, means for supplying current to the line, a current varying transmitter adapted to vary the current strength in the line, and a receiving instrument corresponding to said transmitting instrument and operated by variations in the line current produced thereby, of a pole changing transmitter arranged when operated to change the line polarity, a receiving instrument corresponding thereto and operated by reversal of the line polarity, a magnet operated by a circuit controlled by said pole changing transmitter, contact points controlled by said magnet and arranged to throw into the line for a brief instant when operated a source of current, whereby a current pulsation may be produced in the line, and the receiver corresponding to said pole changing transmitter may be operated independently of the operation of said current varying transmitter.

549,715. Electric Clock System. Adolf Franke, Berlin, Germany. Application filed September 19, 1893.



NO. 549,802.

A master clock is provided with a circuit closer; a series of secondary clocks is provided with hand-setting devices and with circuit closers operated to close and break the circuit at predetermined intervals, and timed to throw the clocks successively at predetermined intervals into the circuit of the master clock, a source of electricity, and electrical connections.

549,794. Lightning and Heavy Current Arrester and Alarm. Miller R. Hutchison, Mobile, Ala. Application filed May 25, 1895.

A spring actuated shunt lever and electro-magnetic locking and releasing devices are employed, as well as a drag switch in the main line disconnected from but operated upon and actuated by the shunt lever automatically in resetting the instrument.

549,802. Telephone Transmitter. Ignatius Lucas, Passaic, N. J. Application filed May 15, 1895.

A telephone transmitter is shown, comprising a casing, a diaphragm, contact disks, one of which is engaged by a point on the diaphragm, and a filling made of silver and placed in the casing at the back of the diaphragm, and embedding the contact disks.

549,803. Telephone Transmitter. Ignatius Lucas, Passaic, N. J. Application filed May 31, 1895.

A material is used composed of a base having granulated carbon thereon, the material being between the opposing faces of the buttons with the carbon in contact with the buttons.

549,810. Electric Switch. William T. M. Mottram, Dallas, Tex. Application filed July 9, 1889.

Juxtaposed pairs of contact points of an electric system are employed with an electric switch, and a contact plate is pivoted to the latter, and has its contact faces on each side of the switch, by which the faces are made to adapt themselves to the position of the pairs of contact points to which they are applied.

549,860. Telephone. Alfred Stromberg and Androv Carlson, Chicago, Ill. Application filed September 21, 1893.

A case is employed, having interior and exterior threads of different pitch, a diaphragm seat with thread adapted to fit the interior threads, and an inclosing cap adapted to fit the exterior thread.

549,874. Electric Speed Regulator. Carl W. Larson, Schenectady, N. Y. Application filed April 8, 1895.

A counter-balanced governor for an engine mounted in universally moving bearings upon a fixed support, yielding power connections between the engine and the governor; and means are actuated by the governor for controlling the speed or power of the engine.

549,876. Electric Motor. Robert Lundell, Brooklyn, N. Y. Application filed March 2, 1893.

An alternating current electric motor is described, having one or more field magnet poles of magnetic material and without energizing coils, a rotary part having multiple arc windings connected to a commutator or current collector, and one or more pairs of current collectors or brushes adapted to bridge two or more of the coils during the time they are passing the field magnet poles.

549,886. Electric Meter. Ralph O. Hood, Danvers, Mass. Application filed June 8, 1895.

Features of construction are an electric motor, a device for reversing the direction of movement of the movable part of the motor after it has reached a definite velocity, and a recording mechanism.

Western Electrician.

EVERY SATURDAY.

Vol. XVII. CHICAGO, NOVEMBER 30, 1895. No. 22

## Automatic Shoe Blacking Machine.

Much effort and considerable money have been expended in the endeavor to produce a practicable automatic machine for blacking and polishing shoes. Electrical power is particularly adapted to this class of work, and so nearly, if not all, machines of this character are electrical, the work of the inventor being to connect the motor with the mechanism for applying the blacking to the revolving brushes and driving the latter in as small a compass as possible, and with a minimum loss of power. The whole outfit must be compact and so encased and supplied with indicators that the customer may operate it without experience and with no fear of soiling his clothing. A coin-operating mechanism must also be attached.

The conditions appear to be fairly met in the machine herewith illustrated, which is now exhibited in Chicago by the Automatic Electric Shoe Polishing Machine company of Washington, D. C. Fig. 1 shows the machine open, giving a view of the mechanism, while Fig. 2 is a picture of the encased apparatus, as it appears ready for operation, showing the ingeniously shaped brass shield for the shoe-brushes at the base.

The machine is about 36 inches high and 18 inches wide, occupying about as much space as an ordinary chair, as shown in the illustration on this page. It is designed to be operated by dropping a nickel in the slot on top and will run a minute and a half, giving ample time for blacking and polishing both shoes. The case is of oak, and a brass hand-rail is provided for the convenience of the customer who prefers to stand rather than sit in front of it. On the top is a dial with a traversing finger and sections designating the several operations, such as: Cleaning—Blacking—Polishing Toe—Change to Other Brush for Shank and Heel—and so on for the second shoe. This is considered an important feature of the machine, because it informs the operator of the action of the interior mechanism and the time at his disposal for completing the work of polishing a pair of shoes.

A one horse power 110 volt motor drives, by a sprocket chain connection, two hollowed-out shoe-brushes at the rate of 1,700 revolutions a minute. These brushes revolve in opposite directions—the one at the right, for the toe, from the operator, and the one at the left, for the shank and heel, toward him. The openings in the shield are so arranged that the operator can only put his foot under the toe brush and over the second brush, a heel-rest being provided with the latter. Thus the foot is naturally drawn to the best position for application. Each brush serves as a cleaner, dauber and polisher for the portion of the shoe which touches it, liquid blacking being automatically forced upon it in small quantity at just the proper instant. Each shoe must, of course, be applied to both brushes, and the best results are obtained by gently moving the shoe about, "feeling" for the bristles, so that every portion of toe, shank and heel will be reached. The case has front and back doors, and the brush shield is removable, so that the mechanism is easily accessible for cleaning, replenishing the blacking, repairs and collections.

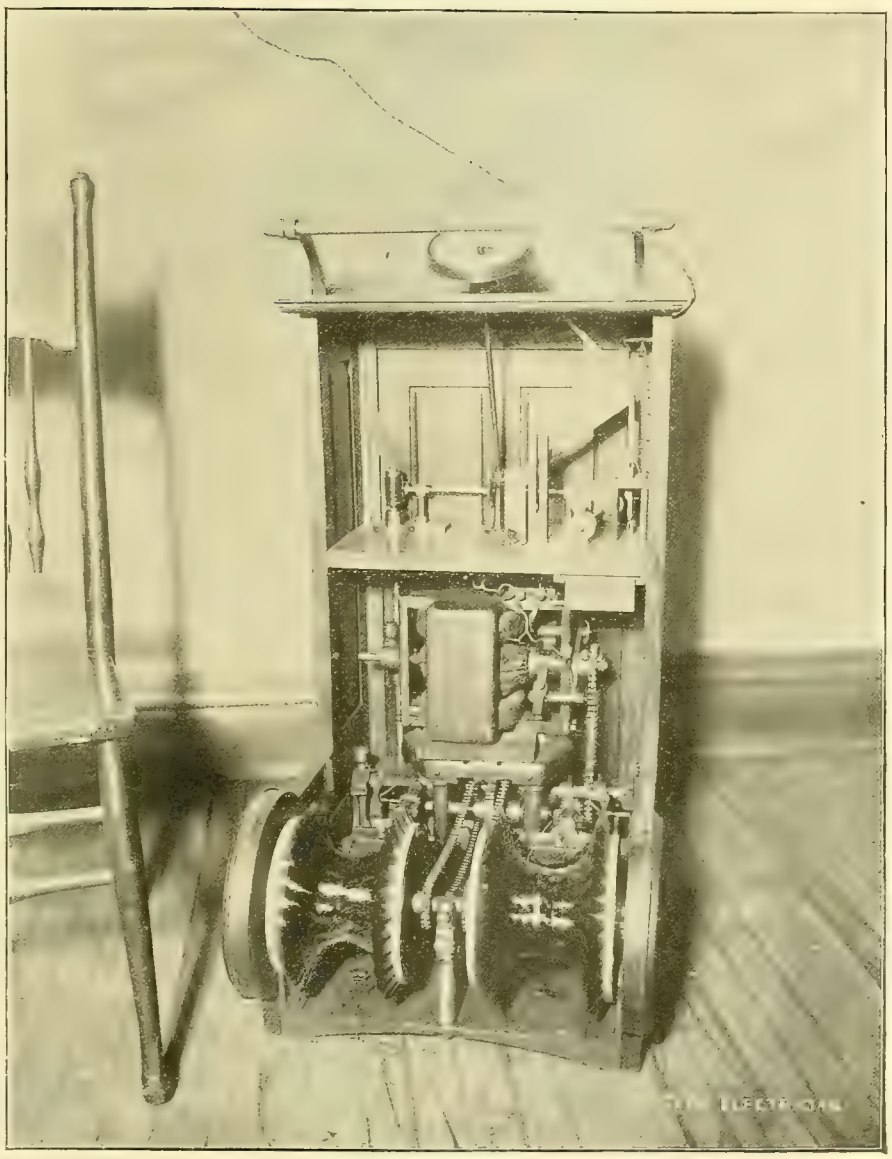


FIG. 1. AUTOMATIC SHOE BLACKING MACHINE.—INTERIOR MECHANISM.

As shown in Fig. 1, the interior of the machine is divided into three parts. On the upper shelf is the coin-operated device, by which, by striking a simple finger switch, the motor is put in circuit. An interrupted gear-wheel, timed for 1½ minutes, opens the circuit after each shoe-brush has been operated twice. Here also are the dial-shaft, revolving the indicator finger twice, showing the different operations for each shoe, and a register which checks off every nickel going into the box.

In the central portion is the motor, power being taken from the commutator end of the shaft. An ingenious shifter is provided by which the shoe-brushes are revolved in opposite directions. The blacking is forced on the brushes by plungers in reservoirs, actuated by an arrangement of dogs and cams. The base of the machine is given up to the shoe-brushes and immediate connections. Much care has been exercised to arrange the shafting, sprocket chains and mechanical accessories as compactly as possible, and no space is wasted. Power is taken from a lamp socket, and it is claimed that the machine is as nearly automatic as can be made.

The company intends soon to bring out a still smaller machine for residences in which power will be supplied to the motor by either primary or secondary batteries. The machine illustrated is intended for public buildings, hotels, club-houses and the like, wherever an incandescent circuit can be tapped.

## Electric Railway Affairs in Chicago.

The overhead construction of the Clark street trolley line, which penetrates the heart of the business district of Chicago, has been completed to Washington street, the terminus. According to the conditions of the agreement made by Mayor Swift with the company, Commissioner Kent says that on the day the first car is run over the road the company will pay $25,000 into the city treasury to be devoted to the street-cleaning fund. The new line will save time for many South Side people and is expected to bring passengers from Englewood and Auburn Park almost as quickly as the steam roads can do.

Electric cars began running on Saturday in Forty-seventh street, between Ashland avenue and the Illinois Central railroad, making it possible to get from Kenwood station to the downtown district in about 35 minutes for a 5-cent fare. The Halsted street electric line extension was put in service on Sunday, the cars running from Fortieth street as far north as O'Neill street, where a transfer to the West Chicago company's cable cars will bring passengers downtown.

The Chicago City Railway company has plans for a new electric line running in Dearborn street, from Lake street to Thirty-second street, except between Polk and Fourteenth streets, where it will run in Third avenue and Custom House place. This extension is said to be in connection with the proposed change of the present horse car line between Polk street and the Northwestern station to the electric system, the joint owners of this being the North Chicago Street Railroad company and the Chicago City Railway company. Ostensibly it is the intention of the latter to make use of its joint right in this line for another north and south road, but it is said that it is more for the purpose of shutting out the General Electric Railway company from Custom House place and Third avenue, the only remaining north and south streets which are now open for the competing line. A bitter fight is now being waged between the two companies for the consent of the property owners. The fact that the Chicago City Railway company has such an extensive system of transfers to the South and West Sides has materially aided it in gaining the signatures of property owners along the proposed route. This line will give the City Railway company four main lines into the heart of the city and leaves it almost master of the field. But the General Electric Railway company has not given up the fight. On saturday it sent out a circular to property owners announcing that it had decided to pay the city $250,000 for an ordinance for an underground system in Dearborn street, Plymouth place and Custom House place, between Twenty-third and Jackson streets.

Elevated railroad companies are planning to bring suburban surface cars over their tracks to the central section of the city. According to statements made by D. H. Louderback it is proposed to devise some plan by which suburban electric cars can be brought upon the elevated ter-

minals six or seven miles from the downtown district and then brought by express over the congested district. The Lake Street Elevated road contemplates bringing through the cars of the Cicero and Proviso Electric line in this manner, and the Northwestern Elevated intends adopting the same plan with the line running through Evanston. The Northwestern is building a four-track system down to Chicago avenue and the two central tracks will be used for express business and will bring these surface line cars through. Surface cars can be brought up to the elevated on a very easy grade.

The Chicago Central Electric company, according to the statement of Mr. Willits, one of its promoters, has secured the requisite frontage consent in Jackson street for the trolley line it proposes to operate. The capital stock is to be $1,500,000, and, besides himself and W. G. McCormick, the persons interested in it are men of New York, Baltimore and Chicago. The Chicago Subway, Arcade & Traction company has completed it plans, and an ordinance will be introduced in the council very soon. The sum of $1,500,000 will be deposited with a trust company on the passage of the ordinance to cover the expense of building the first mile of road. The board of directors includes several prominent capitalists, whose names, it is said, will be withheld until after the passage of the ordinance.

Mayor Swift received a check for $1,000 on November 21st from the Calumet Electric Railway company, being the first installment of the $50,000 exacted by the city for the recent franchises.

## Electrically Driven Shear.

The adaptability of electric motors to the ponderous individual machines of iron and steel plants is well shown by the combination illustrated in the picture, which represents what is undoubtedly the largest shear to which electricity has been applied. This machine was built by the Frank-Kneeland Machine company, Pittsburg, Pa., for the Granite City Steel company, Granite City, Ill. The shear is located n the scrap yard, about 600 feet from the boiler. The suggestion of driving by electricity was made by G. L. Luetscher, superintendent of the works, to attain economy and convenience of transmitting the power, freedom from annoyance of draining and freezing in winter and the ability to operate the machine under all conditions with cheap labor.

The motor is a slow speed, steel frame, constant speed machine. The armature makes but 500 revolutions per minute and is controlled by an extra heavy rheostat that will admit of starting the motor very slowly. This is a very important feature, because the inertia of the flywheel, gear wheel and lever of the shear require great power to start them.

The shear itself is the heaviest of its kind, weighing, with the motor, over 90,000 pounds, and is calculated to exert a pressure of 900 tons at the center of the knives. It has a capacity to cut 4½ inch square soft steel billets, and as large a section of rounds as is now used in railroad axles. The knives are 18 inches long and may be extended to 24; are seven inches deep and 2½ inches thick. The bed is massive, and intended to absorb the great shocks due to heavy cutting. It alone weighs 44,000 pounds. The cutting edge of the knives is exactly central between the housings, thus throwing an equal strain on both housings, utilizing the material in the best manner. The housings holding the main pin are 30 inches wide and 14 inches deep each. They have a bearing and wedge to take up lost motion; they are extended upward to carry a tension bolt 2½ inches diameter, which assists the main pin in its work of holding the spread of the housings.

The main feature of the shear is the recess seven by nine inches, in the tail of the lever, which forms a socket in which the pitman operating it bears. The recess is babbitted and has lubricating holes at the top. The crank operating the pitman is a steel casting having nine inches diameter journals and wrist, while the gear wheel seat is 28 inches diameter and has the key way placed opposite the wrist or point of work. The main gear-wheel is 96 inches diameter, 12 inches face of teeth and shrouded to the pitch line. The arms are H section and the rim is strongly reenforced and carries a counterbalance for the crank and lever. The hub is key seated at four points, so that the wheel may be turned when the teeth that do the cutting become worn. The main pin is steel. The first gears are cut from the solid and are six inches face, two inches pitch. The flywheel is 96 inches diameter and weighs 5,500 pounds; has a turned and balanced rim. The flywheel shaft is six inches diameter, forged steel, and has a substantial outboard bearing and sole plate. The bed, lever and gear-wheels are extra strong iron, cast from the air furnace, and the workmanship throughout is the best of its kind.

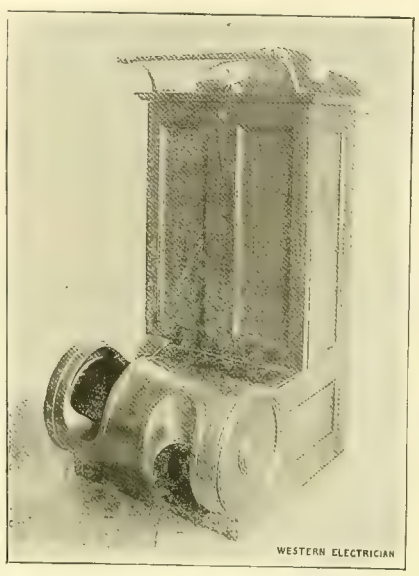
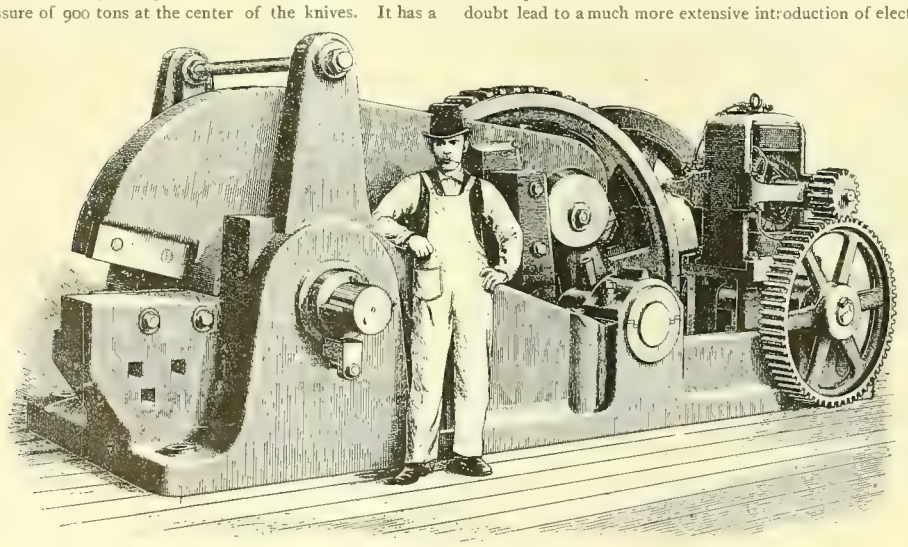



FIG. 2. AUTOMATIC SHOE BLACKING MACHINE—ENCLOSED READY FOR OPERATION.

The *Iron Age*, from which the cut and description are taken, predicts that the use of this machine will without doubt lead to a much more extensive introduction of electric power to drive independent machines in iron and steel plants.



ELECTRICALLY DRIVEN SHEAR.

## Competition in the Fire and Police Telegraph Business.

The interesting announcement is made that James W. Johnson has assumed the western agency of the United States Fire & Police Telegraph company of Boston, and has opened an office at 314 First National Bank building, Chicago. This means an active competition to the Gamewell system in the West. Mr. Johnson is a clean, straightforward business man, well and favorably known to the electrical fraternity through his long connection with the General Electric company and other electrical enterprises in Chicago. All who know him realize that he will stoop to no dishonorable practice in the dealing with municipalities which will be necessary by his new business connection. This will be in refreshing contrast with the current reports concerning the long-continued relations of the older company and the head of the electrical department of at least one large city. The United States apparatus is strongly commended by the authorities of the cities using it, as was developed by the thorough investigation—covering 50 cities—made by Mr. Johnson before accepting the agency. The competition will be largely one of business methods, and the result will be awaited with interest.

## Automatic Time Cut-out.

The arrangement which is illustrated in the accompanying cuts was designed by F. B. Badt of Chicago for the purpose of automatically breaking a circuit after it had been closed for a certain length of time and thus preventing the batteries from becoming exhausted. The device is intended particularly for use in connection with batteries employed in domestic work, such, for instance, as operating electric bells and gas-lighting systems. When used in this manner, the circuits of the batteries are only closed for a short period each time, and hence if the circuits remain in good condition the batteries will last for a long time without attention or renewal. If, on the other hand, the circuits become closed for any length of time, as is often the case, the batteries will run down and in most cases become entirely exhausted, so that a renewal is necessary before the bells or other translating devices can be operated. By the use of this device, the inventor claims, this short-circuiting of the batteries is entirely obviated. The cuts show the arrangement and application of the device. Fig. 1 presents a diagrammatic view of a bell circuit in which it is employed. Fig. 2 is a modification of the arrangement, while another form is illustrated in Fig. 3. It may be stated that the invention consists in employing a device that is affected by changes in temperature in the circuit of the battery in such a manner that the heat developed by the current of the batteries will act, through the agency of this device, to complete a local circuit through an electro-magnet after the current has been flowing in the battery circuit for a certain time, the electro-magnet operating to break the circuit of the battery. In the cuts, Fig. 1 shows a circuit containing a battery $A$, a bell $B$, a push-button $C$ and a coil of wire $D$. The coil $D$ is preferably of some material having a comparatively high resistance to the flow of the current, so that heat will be developed when the current passes through it. Placed within the coil $D$ is a bulb $E$, containing mercury, to which is attached the hollow stem $E'$. A local battery $F$ has one terminal connected with the mercury in the bulb $E$, the other terminal being connected with one terminal of the electro-magnet $G$. The other terminal of the electro magnet is connected with the opening in the stem $E'$. The coil $D$ of the bell circuit is connected by wire $D'$ to the armature $H$ of the electro-magnet $G$. The armature is pivoted at one end and normally rests upon the contact $I$, which is connected by the wire $J$ to one electrode of the battery $A$. A pivoted hook $K$ is provided with a retractile spring $K'$ and is so situated that when the armature $H$ is attracted by the magnet $G$ the armature will be caught by the hook and held away from the contact $I$. When a bulb $E$ and tube $E'$ are used, it is evident that the length of time that must elapse before connection is made between the two wires at the ends of the bulb and tube, when the bell circuit is closed, will depend upon the temperature of the air around the bulb and tube. When the air is warm, the mercury will be nearer the top of the tube, and hence will reach the wire sooner when heat is applied than when the air is cold. This difficulty is obviated by using the compensating devices shown in Figs. 2 and 3.

Fig. 2 shows an arrangement similar to that of Fig. 1, with the exception that the bulb $E$ and tube $E'$ are replaced by the **U**-shaped tubes $L$ and $M$. Each tube is closed at one end and is partially filled with mercury or the like, as shown. A float $N$ is placed on the surface of the mercury in the tube $M$ and has connected to it a conductor or wire $O$. The wire is so shaped that its end $P$ enters the open end of the tube $L$. The closed end of the tube is surrounded by the coil $D$. By this arrangement the distance between the surface of the mercury in the tube $L$ and the point $P$ of wire $O$ will not be varied by changes of temperature of the surrounding air, as the mercury in each tube will be affected alike.

As shown in Fig. 3, two ordinary thermostats $Q$ and $R$ are substituted for the mercury tubes. These thermostats are made of two different metals that have a different coefficient of expansion. The distance between the contacts $S$ and $T$ is not varied by the temperature of the sur

rounding air, as the thermostats are arranged so as to be moved in the same direction by similar changes in temperature

When the bell circuit is open and in working condition the armature $H$ will rest upon the contact point $I$. If now the bell circuit should become closed for any reason, the current passing through coil $D$ will heat the mercury in the tube $E'$. The expansion of the mercury causes it to rise in the tube $E'$, and hence, unless the circuit is broken, the mercury will continue to rise until it reaches the wire at the upper end of the tube $E'$ and completes the circuit of the battery $F$. When this circuit is completed, the magnet $G$ is energized and attracts its armature $H$, so as to move it away from the contact $I$ and break the bell circuit. As the armature $H$

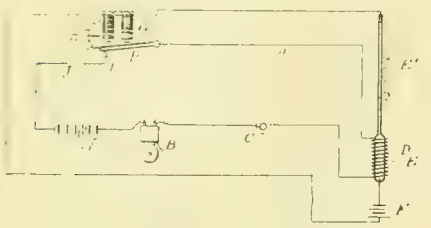


FIG. 1. AUTOMATIC TIME CUT-OUT.

moves toward the magnet $G$ it pushes the hook $K$ to one side, the hook being drawn back by the spring $K'$ after the passage of the armature, so as to hold the armature in its new position. While the armature is in this retracted position the battery circuit will remain open, but can again be placed in operative condition by moving the hook $K$, so as to free the armature and allow it to drop back on the contact $I$. If the battery circuit should be short-circuited, the armature will again be drawn up, and the circuit must then be examined and the short-circuit removed. When such a device as is shown in Fig. 1 is used, the distance between the surface of the mercury in tube $E'$ and the wire in the end of the tube, and hence the time that must elapse before the closing of the local circuit, will vary with and depend upon the temperature of the air surrounding the bulb $E$. To obviate this difficulty and make the time of closing the local circuit practically constant and independent of the temperature of the air, a device like those shown in Figs. 2 and 3 may be used. The mercury in the two tubes $L$ and $M$ of Fig. 2 is affected equally by the temperature of the surrounding air, and hence the surface of the mercury in tube $L$ will always be the same distance from the end $P$ of the wire $O$ so long as the tube $L$ is not affected by the current in coil $D$, and hence the time that will elapse between the closing of the bell circuit and the closing of the local circuit will depend in no way upon the temperature of the surrounding atmosphere. In Fig. 3 is shown another way of accomplishing this result without the use of mercury. In this device the battery current heats the thermostat $R$ and causes it to move so as to bring the contacts $S$ and $T$ together. When this occurs, the local circuit is completed and the bell circuit broken. A separate battery is shown in the local circuit; but this may be omitted and the main current or a portion of the main current utilized instead.

## The Storage Battery for Central Stations.[1]

By Arthur E. Childs.

The object of this paper is to bring before the Institute the main facts and considerations concerning the application of accumulators in electric generating stations both for light and power. The fact that storage batteries have reached a point of high efficiency and low cost of maintenance, has stirred up engineers in this country to consider the application of storage batteries to their own plants, and thus the accumulator has assumed great importance at the present time, especially as power and light stations are so far developed that further increase in generating capacity means large additional expenditure, and in a great many cases the rebuilding of the entire plant.

Realizing, therefore, that storage batteries are eminently practical as auxiliaries, and that their utility and value are acknowledged throughout Europe, it is not surprising that engineers and managers in this country are inquiring about them with the end in view of securing the full measure of their advantages and benefits. In England and on the continent storage batteries have been used in central stations for more than five years, and the success of their application has brought about a great change of feeling regarding them; and the respect with which they are now regarded is an ample indication of the value they have been to managers in the operation of their stations.

It is an acknowledged fact that the great variations and fluctuations of the load on power circuits, especially those power circuits supplying trolley lines, are among the greatest difficulties which engineers have to contend against, and any appliances which will aid them to arrive at a satisfactory running of their station are looked upon with favor by them. It is only in the ranks of those short-sighted engineers, where ignorance and prejudice are the rule rather than the exception, that there are found men who will refuse to consider the storage battery as an auxiliary.

In this paper the term "variation" is used to designate the change of current induced by the adding of lights on to a lighting station, or the cars or motors on to a power station. The term "fluctuation" is used to indicate those rapid and necessary changes of current taking place on the outside line, due to stopping or starting of cars or throwing on or off of stationary motors. Although they may be thus differentiated, they bear a certain relation to each other, and in applying a storage battery a study of the conditions will quickly indicate the type of battery which will be more favorable in each case. By the "type" of battery is meant the slow discharge battery for a long period of service, or the rapid discharge battery for a few hours, or even less time of discharge.

In the lighting station, if we bear in mind the usual form of curve, it will be remembered that the instantaneous changes of current are minute and almost imperceptible compared with the steady increase or dimunition of the total current of the station. Comparing the lighting curve with the usual form of power station curve, it will be noticed that the instantaneous changes of current are enormous compared with that in the lighting station curve. There is a similarity in the two curves in the fact that at certain hours of the day more cars are operated than at other hours, thus producing a general rise in the level of the power curve corresponding to throwing on a number of lights in the lighting curve.

It is not the purpose of this paper to discuss the characteristics of the two curves, but to consider in a general way the application of storage batteries to the wiping out of the fluctuations and variations as they come upon the dynamos and engines. The introduction of a storage battery into a central station acts in a certain sense as a buffer between the external load and the dynamos, taking the shock of the variations without throwing the same on the engines. In this regard they have the effect of reducing the average percentage variation in load on the dynamo from a large amount to a very small one, making the operation of the machines more efficient. In fact, a storage battery acts as a regulator in this instance, maintaining as it does a constant voltage at the switchboard. This introduces the question of the efficiency of engines with varying loads; and, leaving out of account the reports by engine builders, who are naturally interested parties, it is a fact that not

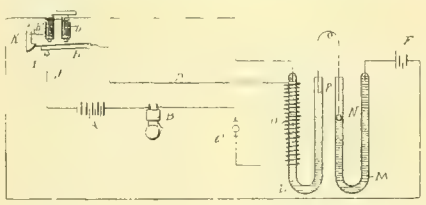


FIG. 2. AUTOMATIC TIME CUT-OUT.

many extended and careful investigations of efficiency under varying loads have been carried out. Prof. W. C. Unwin of the Central Institution, at South Kensington, has shown, however, that a decrease of mechanical efficiency has a serious effect on the economy of working with a variable load, and with a load varying from 100 per cent. to 25 per cent., the efficiency decreases from 85 per cent. to 40 per cent.

As applied to power stations, and especially where water power is used, storage batteries are almost indispensable. The writer knows of several plants where the successful maintenance of a constant voltage on the machines is dependent upon the fact that an attendant sits by the governors of the wheels, and regulates them by hand, as the inertia of the water, even when the best water wheel governor that has ever been produced is employed, is too great to allow the turbines to pick up or throw off the load with anything like the quickness with which it is thrown on or off by the outside circuit. The stations in mind are not small stations, as might be supposed at first thought, but are stations where several thousand horse power and over are generated at certain hours of the day; and it is surprising that engineers of intelligence, who are usually quick to perceive the advantages of new applications, are still allowing their prejudices to prevent them from investigating the merits and value of accumulators as regulating governors in their stations.

In the application of storage batteries to the power station of a trolley system, it is not unusual to find the variation in load as much as 50 per cent. below the average horse power, and even as great as 200 per cent. above the mean load. These enormous fluctuations take place in the course of a few minutes, and are an expense to the railroad companies in at least three ways. In the first instance, they require the use of a dynamo capacity very much in excess of that required where the station is operated at a constant load In the second instance, these fluctuations reduce the life of the machinery of the station, producing a very large depreciation account. In the third instance, the efficiency of the generating plant is very much reduced, as pointed out in a previous paragraph. It has been figured out in a number of instances that could the steam be utilized in a proper manner in the engines driving the dynamos, that at least 40 per cent. more work could be obtained from it.

When considering the application of storage batteries to illuminating plants, it is found that their value is equally as great as in the case of power stations, as the charging of the battery can be done while the plant is operating at light loads, thus making use of the power of their machines to great advantage. At the period of heavy load, the battery is able to take care of the peak of the load, and also to operate the lights during that period of the 24 hours when few lights are being supplied from the station.

The value of an accumulator plant attached to an illuminating station has been thoroughly demonstrated by the New York Edison Illuminating company and the Edison Illuminating company of Boston, and recently in the plant of the Lawrence Gas company, Lawrence, Mass. In the latter case the battery is used in connection with their Edison three-wire system, and is used in the regular way of carrying the peak of the load during the busy hours of lighting. A secondary use of this particular battery is that at noon, when the large mills on the Merrimac at Lawrence shut down, they back up the water into the river above and entirely cut off the supply to the wheels of the gas company (for some 25 or 30 minutes) which are thus unable to operate the machines furnishing light and power until the overflow of the water which is dammed back comes down and allows the station to be operated. This short period of absence of water is taken care of by the storage battery plant.

The storage battery can also be used as a valuable adjunct to both power and lighting stations at points in their systems where it is difficult to maintain the voltage at periods of heavy load. In these cases the feeders are usually not sufficient to carry the whole current direct from the station. But during the periods of small load the feeders can be utilized up to their maximum allowable drop in potential to charge battery sub-stations placed at these weak points. When the load at such points becomes greater than the capacity of the feeder, the battery comes into play and carries the load in connection with the station supply at that point, thus maintaining the voltage and doing satisfactory and valuable service. There must be hundreds of street railroads in this country that have just such weak points, and it will only be in accordance with the established progressive character of American street railway and lighting engineers to investigate the value to them of a storage battery, as soon as it has been brought thoroughly to their notice. This cannot but result in a widely extended use of the storage batteries for this purpose; and the expectations of those interested in storage batteries would not be exceeded if half the street railroads and direct current lighting plants in this country and Canada should adopt within the next few years storage batteries either at their central stations or at sub-stations, the more especially as they can now obtain storage batteries which are thoroughly reliable, and which can be installed under a guarantee.

The extent to which storage batteries have been used in England and on the continent is very great; and it will surprise many engineers in this country to know that there are more than 20 lighting stations and several thousand insolated plants in Great Britain alone using storage batteries. Further than this, there are in Germany 5,000 isolated plants and 15 railway power plants using storage batteries. In fact, 80 per cent. of all the central stations in Germany and Austria are equipped with storage batteries. In addition to the above, there are many stations in France, Italy, Holland, Belgium, Sweden, Norway, Denmark and Spain, and two or three in Switzerland.

A survey of the progress which storage batteries have made in European countries indicates no very great change in the principles of construction, but the results seem to be rather due to a thorough analysis and appreciation of the requirements of each case. This has resulted in a proper use of batteries and a correct recognition of the limitations of their usefulness. This fact alone has contributed largely to their successful application. The great difficulty in this country has been that engineers have not recognized a proper limit to the usefulness of a battery, but have, in many cases, far exceeded their specified limitations, and in this way have injured the batteries and cast discredit on them. It would be just as reasonable to overwork an engine until injured or worn out, and then declare that all engines are useless and expensive mechanical contrivances.

One point which has contributed largely toward the success of storage batteries in Europe is the fact that engineers have endeavored to obtain long life and high efficiency even at the expense of increased first cost, and instead of attempting to obtain a large output per pound of element, they have limited themselves to a reasonable number of ampere-hours per pound. The result of this has been that the batteries in use in Europe have shown great endurance and solidity. The experience, however, which has been obtained with

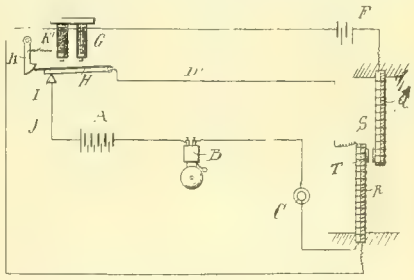


FIG. 3. AUTOMATIC TIME CUT-OUT.

many American batteries has not been so promising as on the continent, owing to the lack of proper appreciation of them. It would be greatly to the advantage of American engineers if they would follow the lines laid down by their European confreres, and if, instead of waiting for some marvelous development in the manufacture of storage batteries, they should make use of the existing high class and efficient batteries which are now offered to the public, and by using them in a reasonable manner they would obtain valuable and even remarkable results.

Great progress has recently been made in manufacturing large batteries which have a capacity large enough to take care of the needs of central lighting and power stations, and engineers need no longer complain that they are unable to get the large cells which they require. In fact, manufacturers can produce cells having almost any given capacity.

Considering the efficiency of a storage battery, the factors

1. Communication presented at the meeting of the American Institute of Electrical Engineers, November 20, 1895.

which tend to reduce it are due to a loss in voltage and in the quantity of current. These losses, however, are not so serious as they have been in the past, and manufacturers are at present able to guarantee a very high efficiency. In cells which were submitted to Prof. H. L. Callender an ampere efficiency of 96.1 per cent. was recorded, the watt efficiency being 84 per cent. In certain instances, however, known to the writer, these efficiencies have been slightly exceeded, and complaints from central station managers that they cannot obtain efficient cells are now groundless, as with the efficiencies named an eminently satisfactory service can be obtained. It must be borne in mind that a loss of 16 per cent., or even 20 per cent., in the efficiency of the battery does not mean the loss of the same percentage in the output of the station, as the battery usually supplies, approximately, or even less, of the whole output in watt-hours, and it is, therefore, from that fraction of the whole output that the loss in the battery must be deducted.

In the matter of cost of maintenance of a storage battery outfit, it is now usual for the manufacturer to guarantee a fixed annual percentage. This percentage varies from 10 per cent. in small plants to a smaller percentage in large plants, depending, of course, on the conditions of operation and the use to be made of the battery, a study of which will soon determine what percentage can be guaranteed. In first-class plants, well installed and operated by careful engineers, the cost of maintenance can be reduced to the vicinity of 3.5 or 4 per cent. It is customary for the manufacturers to enter into a contract, in the case of large plants, guaranteeing that the cost of maintenance shall not exceed a certain percentage per annum for the period of contract. This can be carried out in two ways. Either the lighting or railroad company can pay the manufacturer the percentage specified every year, and the manufacturer will inspect and keep the battery in first-class condition, or the company employing the batteries can inspect and order renewals themselves, in which case, should the cost of maintenance exceed the percentage guaranteed, the manufacturer will not charge more than the specified amount. This is an exception rather than the rule, however, as the cost of maintenance is usually somewhat lower than that specified by the manufacturers, so that the company owning the battery is the gainer by the difference in percentage. By a thorough attention to details, both large and small, the percentage can be kept down to a very low figure; and it is to be regretted that the practice of engineers which prevails in Europe, of treating the battery with care and consideration, does not seem to exist among the engineers of this country, to the detriment of their own lighting or railroad plants, which would otherwise be able to utilize batteries in an efficient manner.

It must not be assumed from the above that storage batteries require an inordinate amount of care and trouble. On the contrary, they do not require either expense or great care. All that is demanded is regular and systematic attention on the part of those having them in charge. When such care is exercised, it is found that batteries perform a very valuable service, and largely reduce the operating expenses of the station—in many cases as much as 30 to 35 per cent. This reduction in operating expenses is, of course, due to the saving in cost of coal consumed—a saving which could not otherwise be obtained. Where water power is employed a storage battery enables the water wheels to be operated for 24 hours, storing current while the station output is reduced to a minimum, and aiding the station during the busy hours of the day. In many cases this practically doubles the output of the station without increasing the cost of installation to a corresponding amount. In fact, in many cases where water power is used it would be impossible to double the power of a station, as there would not be enough water at hand to give double the power. This is especially true in those sections of the country where the power of small streams has been utilized and where the flow of water is continuous but not very great. In addition to a storage battery acting as a receiver for storing the current while the station is not giving a large output, it also maintains, during the operation of the station, a perfectly uniform voltage, which would not be obtained with the varying load direct upon the water wheels, on account of the difficulty in governing previously mentioned.

When an entirely new power plant is to be built, there is no doubt that by adopting the storage battery in the first instance the initial cost of installation will be less than for the plant not using storage batteries, and the cost of operation of the station will certainly be very much reduced when the station uses storage batteries. In the case of existing plants which have to be extended, it has been proved that a kilowatt-hour capacity can be added more cheaply to the station by the addition of storage batteries, than by the addition of generating machinery, while, of course, the cost of operation is much reduced.

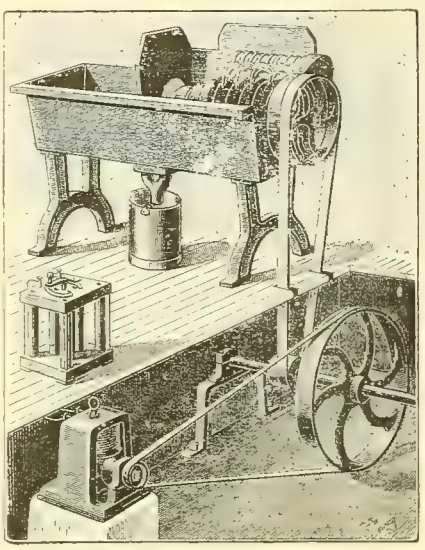


FIG. 2. LABOR EXPOSITION AT THE PALAIS DE L'INDUSTRIE, PARIS, FRANCE.—GENERAL VIEW OF THE PLATE WASHER.

Referring to the primary cost of storage batteries, the cost per kilowatt-hour output is relatively greater for small cells than for large ones, since the cost of manufacture is reduced per kilowatt-hour in the larger sizes, whereas the jars and tanks which are used to hold elements do not decrease very much with the decrease in size of the elements. The cost of shipment and erection are, of course, slightly less per kilowatt-hour with the larger sizes than with the smaller ones, and on the whole the cost per kilowatt-hour with the larger cells is less than with the smaller sizes. It is stated by the Electric Storage Battery company that they are now installing large plants of the Tudor type at a cost per kilowatt-hour of about $37 to $40, which cost, it is understood, can be reduced in the larger stations. The question of cost, however, is one which must be studied out in each case where it is proposed to install storage batteries, and a consideration of the cost of installation of storage batteries, with their attendant reduction in operating expenses, will very soon bring to the mind of purchasers that it is cheaper to invest in accumulators than to invest in additional boilers, engines and dynamos.

As previously stated, it has been the object of this paper to bring before the Institute the general facts and considerations relating to the installation of storage batteries as auxiliaries to power and lighting plants. Lengthy descriptions of plants already installed have been avoided, and those interested are referred to the published descriptions which are constantly appearing in the technical journals.

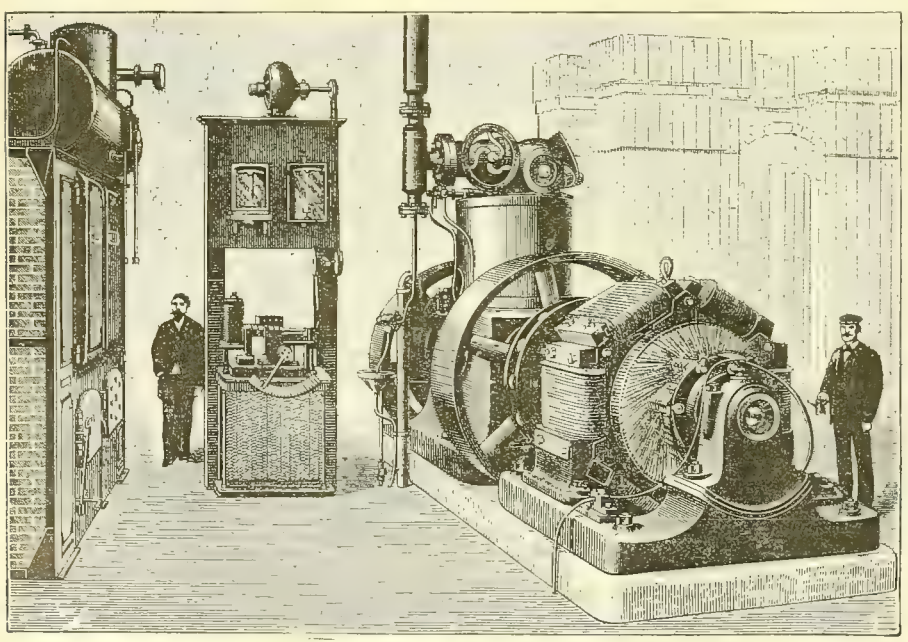


FIG. 1. LABOR EXPOSITION AT THE PALAIS DE L'INDUSTRIE, PARIS, FRANCE.—GENERAL VIEW OF THE DYNAMO AND BOILER ROOM.

## The Storage Battery or the Gas Engine as an Auxiliary.[1]

By Nelson W. Perry, E. M.

Whether it is economical or not to equip a central station with an auxiliary storage battery plant is a question which must be decided separately for each particular installation. Generally speaking, the question will be decided by the character of the load line—a broad topped curve being the most unfavorable, and a sharp peak the most favorable to storage battery economy. Again, a station having a very light day load may use the battery to good advantage, even though its night load may present a broad topped aspect.

Aside from purely economic reasons convenience may be controlling, so that it is impossible to state; unless all the conditions are known, whether the storage battery is advisable or not.

The price of the battery is an important element of course, but less so than popularly supposed, for the space which it occupies and the cost of maintenance may largely overbalance any gain in first cost over the cost of the extra boiler, engine and dynamo.

In regard to the cost of maintenance, manufacturers are willing to guarantee that it will not exceed 10 per cent. per annum, but it is well to understand just what this 10 per cent. means. It means, in the first place, that if you put in all the battery power that the manufacturer recommends, and take care of the battery exactly as he says, then the guarantee holds good. Under such conditions the manufacturer is undoubtedly safe, but if we install a plant under these conditions we are pretty sure to find that the economy in first cost of the battery over engine and dynamo has entirely disappeared.

Then it is well to understand beforehand what the 10 per cent. means—10 per cent. of what? The public are given to believe that this means 10 per cent. of the cost price of the batteries, and the statement has been freely made that this is what it means.

Some time ago I had occasion to inform myself accurately on this subject, and to this end entered into quite a correspondence with the president of the leading storage battery company of this country. As regards the guarantee he wrote me under date of June 18, 1894, as follows:

"We send you by to-day's mail our illustrated catalogue, and would especially call your attention to the question of maintenance as contained on page 11. We undertake, in these cases, to provide renewals when renewals are required at a specific price, with a guarantee that this will not be required sufficiently frequent (*sic*) to exceed an average of 10 per cent. per annum. We have every reason to believe from our experience so far that the actual cost of maintenance when the batteries are used at normal rates will not exceed 5 per cent."

Turning to page 11 to see what this meant, I found the following:

"This company is prepared to undertake maintenance contracts according to a scheduled rate of charges for periods up to 10 years or longer, under which they will guarantee that the total amount paid for renewals during the term of the contract shall not exceed 10 per cent. per annum on the *catalogue* price of the cells specified in the contract. . . . *In all cases of renewal by* contract the old material becomes the property of the company, *and must be returned to their works free of charge for carriage or packing.*"

(The italics are mine.)

Since the regular trade discount at that time was 20 per cent. of the catalogue price, and a further discount was offered which made the cost of the batteries comparable with that of an engine and dynamo, the guarantee assumed a very different aspect from that which it bore on its surface. When to this was added the cost of packing and carriage back to the factory it ceased to be an attractive guarantee, and my calculations showed that in many cases where the storage battery might be recommended, if the guarantee was what it appeared to be, it would not be economical under the guarantee as it actually was.

This petty deception, together with the application of the battery to uses for which it is not adapted, has brought it into an ill repute from which it will take a long time to recover, and for which the manufacturer has only himself to blame.

As before indicated, there are some situations in which either convenience or extreme steadiness of current may be controlling in deciding the question of the use or not of storage batteries. But where the question is one purely of economy, I would not myself recommend their use under any circumstances, simply because there is a still more economical method at hand. I refer to the gas engine. Even if it were necessary to use illuminating gas from the street mains it would be more economical (considering space and other factors), to take the peak of the load with a gas engine than to install a battery for this purpose. In this case there would be no standby losses and the engine would be ready at a moment's notice to be thrown into service.

It is a fact that has been amply demonstrated by others as well as myself, that a given number of lights can be produced with half the gas burned in a gas engine that is required to produce them in ordinary burners. The mechanical efficiency of the gas engine is not quite so high as that of large compound condensing steam engines, rarely ever exceeding 83 to 85 per cent., while the latter may go to 90 per cent., but the total efficiency from fuel to the pulley of the gas engine is about double that of the steam engine—reaching 25 per cent. under favorable conditions, whereas

1 Communication presented at the meeting of the American Institute of Electrical Engineers, November 22, 1895.

with the steam engine it rarely equals 12 per cent. So that with the gas engine operating at anywhere near its full load, there would be a gain in efficiency, instead of a loss, of say 20 per cent. where the battery was used.

As indicating the performance of a gas engine using illuminating gas at various loads, I quote the following figures obtained from a test of a 12 horse power (actual) gas engine.

| Actual H. P developed | Gas consumption (cu. ft.) each actual H. P. |
|---|---|
| 12 | 15. |
| 11 | 15.3 |
| 10 | 15.5 |
| 9 | 16. |
| 8 | 16.5 |
| 7 | 17. |
| 6 | 18. |
| 5 | 19. |
| 4 | 21. |
| 3 | 26. |
| 2 | 30. |
| 1 | 48. |

These figures are somewhat better than would be obtained in practice, but go to show that the gas engine compares favorably at light loads with the steam engine, under similar conditions.

Thus far I have spoken only of illuminating gas, but the power may be much more cheaply generated by using a fuel gas.

The cost of producers or generators comes to about $11 per horse power capacity—considerably less than the cheapest boiler, and an idea of the space required may be gained from a statement of J. Emerson Dawson, who, in estimating for a plant of 400 kilowatts capacity, says that if the gas plant is all on one level it would occupy a ground space of 27 feet by 54 feet, but, if necessary, all except the gas holder can be placed under or over the engine room. His estimate for such a plant is, including erection, foundations and ash pit for generators, $5,500 or $10.38 per horse power.

These fuel gas generators can utilize advantageously the poorest grades of fuel, and produce from the better grades of anthracite about 160,000 cubic feet of gas of a calorific value equal to one quarter that of 16 candle power illuminating gas per ton of coal.

As to the standby losses of the gas producers, this has been very carefully determined in a number of cases. As an illustration I will cite a single case—by no means the best on record.

At Openshaw a generator which supplied gas for from 250 to 300 indicated horse power was shut down for 41 hours and the fuel consumption during this time was but 3.9 pounds per hour or about 1 per cent. When we compare this with the standby losses of the steam boiler, which are estimated by Prof. Kennedy at 10 per cent. of the total consumption in all the boilers, we see how insignificent it is.

A situation usually considered peculiarly adapted to the storage battery is in subordinate or outlying stations where they are charged during the daytime from the central station and act as centers of supply during the nighttime.

But gas can much more economically be distributed to these stations than can the electric current, for Denny Lane[1] has shown that with ordinary 16 candle power gas 3,000 horse power can be sent a mile for an expenditure of one horse power, or one-thirtieth of 1 per cent. of the power conveyed.

My own calculations show that a six-inch pipe will deliver 6,000 cubic feet of gas per hour at a distance of 10,500 feet under four inches of water pressure. If this be 16 candle power gas, allowing 25 cubic feet per horse power hour, this quantity represents 240 horse power.

Cast-iron pipe, six inches in diameter, having a thickness of one-half inch, weighs 31.9 pounds per foot. The total weight of this two miles (nearly) of pipe will therefore be 334,950 pounds. This would be equivalent in conductivity to about 41,869 pounds of copper. But four miles of copper weighing 41,869 pounds would be equivalent to about four No. 000 B. & S. wires, which would have a resistance for the four miles of .325 ohm. If the charging current were transmitted at 220 volts, there would be required a current of 848 amperes; but a wire having a resistance of .325 ohm will only deliver under a pressure of 220 volts 220÷.325=677 amperes, there would, therefore, be required five No. 000 B. & S. wires to deliver this energy, and the weight of this would be 53,540 pounds.

If the distribution took place at 1,000 volts, the amperes required would be approximately 180. To deliver this at the same distance with a loss of 10 per cent. would require 6,264 pounds copper, and to deliver it at 1 per cent. loss would require 62,642 pounds, which would cost far more than the pipe and still give less efficient transmission.

I think it would be very easy to prove that the gas engine with fuel gas would prove a much more economical auxiliary to the central station for taking the peak of the load and the loads amounting to fractions of a unit, than the storage battery, and when we consider the efficiency of transmission of energy in the form of gas, which will permit of the location of the gas generators where land is cheap and fuel easily procured, it seems to me that the plan must commend itself to electrical engineers.

Unfortunately the gas engine business in this country seems to be in the hands of persons totally incompetent to handle it properly, as everyone knows who has ever had occasion to seek information from them.

It is probably not too much to say that every attempt thus far made in this country to adapt the gas engine to electric lighting has proved a failure. Our own manufacturer, either do not know what their engines are capable of doings or else they are afraid to make public what they will do. I believe there is not a single manufacturer who has a printed price-list, and my own experience and that of others whom I know has been that it is impossible to get prices quoted until the manufacturer or his agent has been thoroughly satisfied of the exact purpose for which the quotations are desired. Information of any kind is almost impossible to get; and guarantees of performance, when given, are worthless. To such an extent is this true, that nearly all, if not all the recent large orders for gas engines have gone abroad, where the business is conducted on business principles.

In England, Germany and France the gas engine has come into extensive use in isolated lighting, and already has been adopted with satisfactory results in several central stations of considerable size

When the business is properly handled in this country we may expect to see the gas engine make its way rapidly in the lighting industry here also, for it has merits which need only be known to be appreciated.

1. *Electrician*, October 9, 1891

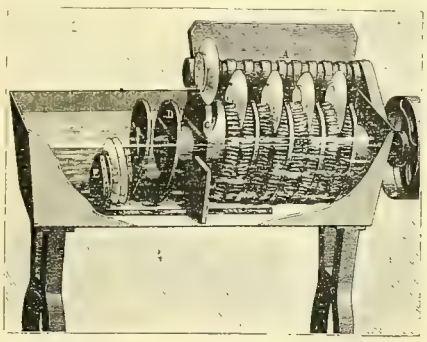


FIG 5. LABOR EXPOSITION AT THE PALAIS DE L'INDUSTRIE, PARIS, FRANCE.—DETAILS OF ELECTRIC PLATE WASHER.

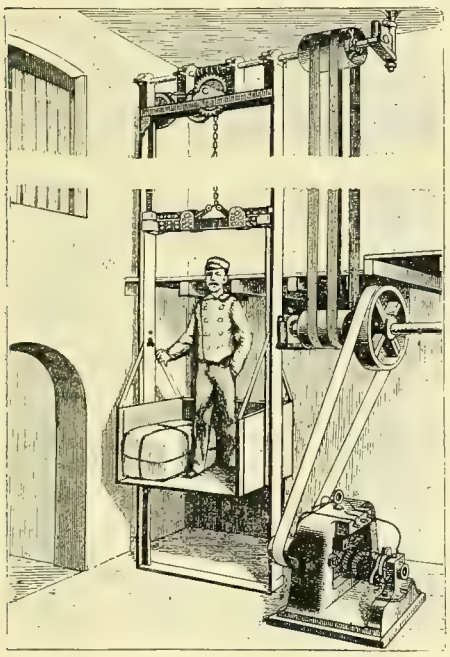


FIG. 3. LABOR EXPOSITION AT THE PALAIS DE L'INDUSTRIE, PARIS, FRANCE.—FREIGHT ELEVATOR RUN BY A MOTOR.

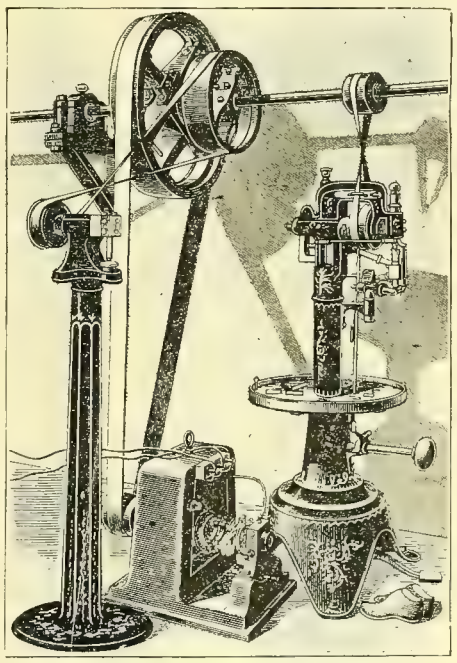


FIG. 4. LABOR EXPOSITION AT THE PALAIS DE L'INDUSTRIE, PARIS, FRANCE.—SHOE FACTORY MACHINERY RUN BY ELECTRICITY.

## Labor Exposition at the Palais de l'Industrie, Paris, France.

The object of these labor expositions, the third of which has been held at Paris, has been educational—bringing before the people the products as well as the methods and manufacture of these models of machines and convincing evidences of the value of the material and workmanship of articles which are carelessly viewed in the stores and shops where they are sold. The grand nave of the Palace of Industry, which is soon to disappear forever to make way for the greater glory of the 1900 exposition, was filled with products of every conceivable description.

The exposition of 1895 included a huge electrical installation. A battery of boilers of 1,800 kilograms capacity furnished the steam under a pressure of 13 kilograms per square centimeter, and the boilers were arranged and tested for the greatest possible amount of security. In Fig. 1 is given a general view of the electrical generator employed. The boilers are at the left, while the engine and dynamo are seen at the right, and the center is occupied by the regulator, which is an automatic apparatus. The engine is a compound Westinghouse of 100 horse power having a speed of 300 revolutions. As will be seen, it is directly connected to a Thury dynamo, a six-pole machine of 70 kilowatts capacity at 110 volts. The automatic regulator is actuated by an electric motor of 125 watts, in derivation, which stands on the summit of the distribution board. When a variation of the voltage occurs the rheostat crank is moved up or back as required.

About 200 lamps of 16 candle power were installed in the crystal pavilion, and a number of motors were to be found in the various parts of the building.

In one place was a platewasher run by a 0.396 kilowatt Thury motor making 2,500 revolutions, which by the help of a channeled shaft *A*, Fig. 5, aided the revolution of the plates, and at the same time carried the plates along from right to left past the brushes, where they were picked up by the screw *C D*, and finally piled at *E*, in the rinsing water. This machine will wash 2,000 plates per hour, and does its work perfectly.

A freight elevator is shown in Fig. 3, run by electric power transmitted by belt from the motor. The motor is of 1.65 kilowatts capacity, with an angular velocity of 1,650 revolutions per minute, an endless screw acting on a cog which carries the elevating chain.

A shoe factory on a small scale utilizes a motor of 1,650 kilowatts, and keeps several cordwainers busy. Fig. 4 shows two pieces of shoe machinery.

A machine shop has several motors, one of 0.803 kilowatt, one of 0.396, and one of 0.396, the latter in a wood turning corner.

In another part of the building is a veritable glass factory. At the door is seen the sand, the carbonate of soda and the other matters used in the manufacture of glass. The molten mass is drawn from the crucible on the end of long tubes, and blown into cylinders. The master blower receives them and completes the operation by passing these to a cutting machine which takes off the upper end, after which they are split lengthwise and flattened. All these scenes are reproduced with great exactness by the aid of wax figures of life size. The positions are natural, and incandescent lamps in red paper sacks well simulate the molten matter, and give the whole a truly realistic appearance. At the farther portion of the room was a motor of 5.5 kilowatts making 1,300 revolutions actuating a cutting and polishing machine, and there was also a mimic representation of the stone carriers of Lèrouville.

The labor exposition of 1895 brought to public notice a large variety of electrically propelled machinery.

## Additional Lighting Equipment for Lincoln Park.

In addition to the proposed enlargement of Lincoln Park, Chicago, other improvements are being considered. Commissioner Henrici advised the purchasing of more electric lamps and poles and that a better lighting service in general be made in the parks. Acting on this, the superintendent was authorized to buy 700 electric light poles that were used at the World's Fair grounds. In addition to this it is determined to buy five new dynamos and three engines, and to put up in the park 400 of the new poles. With the underground wire and system complete it will cost $50,000. Commissioner Jamieson is in favor of keeping the parks lighted and open to the public until 12 o'clock instead of closing at nine o'clock, as is done during the fall and winter months. This will probably be done, as it is favored by several of the members.

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CIRCULATION, 16,630.

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THE storm of Monday last was very trying upon the electric companies of Chicago. The telegraph and telephone companies were sufferers, and their wires were down in every direction. It is gratifying to note the reports from the trolley lines of the city. Their work compares very favorably with that of the cable lines. It was one of the most trying ordeals which the cable companies of Chicago have had to contend with.

ACCORDING to our Milwaukee correspondent, the Wisconsin Telephone company is again engaged in a controversy with its subscribers over the schedule of rates charged and other questions of management and policy. The company, it is claimed, maintains high rates and gives poor service, and the subscribers are endeavoring to secure more favorable terms and improved service. The Wisconsin company is a powerful corporation, one of the strongest Bell concerns in the country, in fact, but Milwaukee, in which the dissatisfaction is principally manifested, has many public-spirited citizens who would gladly furnish money with which to conduct a war on the old monopoly. Thus the outlook for a lively struggle is promising. In the meantime anti-Bell companies operating throughout the territory of the Wisconsin Telephone company will rejoice in the knowledge of that company's trials and make the most of the difficulty. The Milwaukee company has not shown any forbearance toward its weaker competitors, and the latter are not likely to overlook the present opportunity to retaliate. From the information at hand it would seem that the old company had a serious problem confronting it.

FOR two reasons the announcement of active, straightforward competition in the business of supplying fire and police telegraphs to municipal corporations in the West is gratifying. These are: First, the fact that a monopoly in this branch of the electrical industry is as bad as in any other, and should be combatted for the general good of the trade; and, second, the desirability of clean, business like methods in selling this class of apparatus to city officials, as uncontradicted statements of improper "influence" and "deals" in transactions of this character are widespread. It is to be hoped that the existence of alert, honest competition will put a check to this state of affairs.

THE announcement is made in New York, apparently upon authority of John D. Crimmins, that important extensions of the present underground conduit lines in that city will be made at once. Several announcements in similar strain have been made since the experimental road was equipped a few months ago, but heretofore little attention has been given these reports, owing to the fact that up to the present time there has been no real test during severe weather. While it is admitted that a successful underground road can be built if enough money is expended upon it, there is no doubt that considerable experimental work still remains to be done before a system is devised that can compete with the overhead trolley. It will be a matter of considerable surprise therefore if Mr. Crimmins extends the present system before next summer. There are many problems to be solved in the meantime, and there is no reason why the new lines should not have the benefit of the experiments now being conducted. The Metropolitan company is entitled to praise for the enterprise it is displaying and the manufacturing company's work in this connection is also commendable.

WHEN the "doctor" assumed the role of chief apologist for his friend and patron, the "professor," he did not understand the nature and extent of the task he was undertaking; it would seem, for he has already shown signs of discouragement and dismay. He has given up all hope of successfully defending his patron, and in the last issue of the *Electrical Journal* makes this plain by the announcement that that publication withdraws from the "controversy" and that no further attention will be given the matter. It will be noticed that no attempt to answer the charges presented has been made. Realizing their inability to present a defense, the "doctor" and the "professor" have agreed to adopt a policy of silence. Grave charges are to remain unanswered and unexplained. No attempt will be made to clear the stains from the record of this public officer. The 'professor" hopes that the matter will be allowed to drop out of sight—he is relying upon the apathy of the public—but in this he is ill-advised. He has sinned too openly and too grievously to be forgiven or forgotten without due reparation and punishment. Whatever the nature of the satisfaction exacted, one thing is certain: John P. Barrett is discredited in the electrical fraternity and in the community, and every enterprise with which he may be connected will be looked upon with suspicion.

IT would seem as if the Pacific cable project had a fair chance of being accomplished. A cable dispatch from London announces that Joseph Chamberlain, secretary of state for the colonies, has agreed to appoint a commission to arrange the details of the construction. The imperial government, Australia and Canada will each appoint two delegates upon the commission, which will proceed with its work as soon as possible. Not only the colonies directly interested, but Natal and Cape Colony were also represented at the London conference, and this was construed as indicating the general sympathy with the scheme which is felt throughout the British possessions. Mr. Chamberlain expressed the opinion that the project would make a fair return upon the capital employed. Of course a cable between Australia and the Dominion calls for government support on strategic grounds, and it is presumably on these, rather than on the promise of commercial benefits, that the appeal is made to the imperial authorities to take part in the project. It is contended, too, that the argument used for laying a cable from Halifax to the Bermudas applies with additional force to the Pacific telegraph, which would not only connect Australia and New Zealand with Canada, but take in the Fiji and other islands, including, perhaps, Hawaii, provided an arrangement can be made for connecting the cable with this last named group. With the construction of the British cable it is feared the prospect for an American enterprise is by no means promising. This country had an excellent opportunity to establish telegraphic communication between San Francisco and Honolulu, but the policy of the administration toward Hawaii was not favorable to such a project and scarcely any practical headway has been made excepting in surveying the routes proposed, and this was authorized under a former administration. Had the annexation of Hawaii been favorably considered it is probable that the cable would now be an assured fact. But the project was checked by the government, an excellent opportunity to gain possession of this ground was rejected, and to-day there is fair prospect that England will take advantage of the stupidity of the officials at Washington, who were unable or unwilling to see the importance of this undertaking.

NEVER before in the history of Chicago has there been so much activity displayed in street railway circles as during the year now drawing to a close. There have been many important developments, numerous changes and extensions of existing lines and marked improvement in the character of the service given. Yet, we have not seen the end; indeed, it would be rash to say that the most important work in this line has been completed. At the present time the projectors of new roads, especially on the South Side, are particularly active. Established companies are extending their systems, new companies are entering the field and there are concerns asking franchises about which little if anything is known. Some of these may be legitimate enterprises. It is certain that others are not pursuing a policy tending to promote public confidence. Franchises are being sought by persons who publicly announce their intention to sell out, and are in fact actually negotiating the sale of these franchises before they are passed by the council. One of these companies recently announced that it was sure of getting its franchises through the council and that it was negotiating with eastern capitalists with a view of disposing of them; in fact, an option had been given upon the franchises before they were granted. Such transactions have a tendency to harm legitimate enterprises.

AT the present time there is much interest displayed in everything tending to promote storage battery applications, and as there is comparatively little reliable information to be had upon the developments of late years in this line, a discussion of the subject by experts must of necessity prove advantageous. The interest shown by central station men is explained by the fact that further development of the generating capacity of many of the larger plants of the country can only be accomplished by large additional expenditure and in many cases by rebuilding the entire plant. Then, too, engineers are coming to acknowledge pretty generally that a storage battery equipment as an auxilliary is in many cases very economical; that it adds to the efficiency of the installation, and that the character of the service of the stations thus equipped is greatly improved. There are also many special applications of the storage battery from which numerous advantages may be gained. The field of successful utilization of storage batteries has heretofore been necessarily limited, but it is now being broadened and extended, and intelligent consideration of the adaptability of the accumulator to special requirements of service is securing its introduction in many new offices. But advancement on this line can only be made after careful study of the problems involved and by full discussion of the merits of the plans proposed. It is to be regretted that the importance of this fact has not heretofore been appreciated by those most interested in storage battery work. Unfortunately, they seem to have been under the impression that it was necessary for them to make sensational claims of their ability to do many things which they must have known storage batteries were not well adapted to, and in these cases of course it needed only a trial to demonstrate this fact. It may be accepted as an encouraging sign of advancement that the subject of "Storage Battery Applications" is being seriously discussed by prominent engineers to-day in the same conservative tone that might be expected in the consideration of any engineering problem. Heretofore the discussion of the storage battery has been conducted mainly by exploiters of various types who possessed no accurate knowledge of the subject, but who made reckless statements which in time reacted upon the entire business. The present discussion, conducted under the auspices of the Institute, is in different tone, and the participants are men of experience and reputation. Their contributions to the Institute proceedings do not exhaust the subject by any means, and we trust that the views of other engineers of standing will be added to those given elsewhere in this issue. We trust, too, that in future consideration of this subject the same conservative tone may be adopted. It will be a good thing for the business.

## Model Electric Mail Car.

A new model electric mail car made its first trial trip over the West End tracks, Boston, for the purpose of inspection the other day. It is a complete postoffice on wheels. The car is one of the new electric postal cars which are being built at the car works of the West End street railway to expedite the delivery of mails in the city and the suburban offices which come under the Boston Postoffice. The car has straight sides like the mail cars in use upon steam railways. It is painted outside a creamy white, ornamented, numbered and lettered in gold, with red edges. It is one of the handsomest cars in outside decoration to be seen in Boston. The ground glass windows in its roof read in black letters, "United States Mail" and "R. P. O." On the sides, in large letters, are "U. S. Mail." It is lighted on the inside by many incandescent lights, placed in the ceiling and on the sides. Daylight enters through two large windows on each side and one on the front. On each side is a door. The front and rear platforms are guarded by swinging gates and a circular dasher. The body of the car is 16 feet long. It has two motors and General Electric controllers. In addition to this there is an electric cancelling device. The electric current which supplies the motive power and light for the car also supplies the electric motor which is to run the cancelling machine, which occupies a corner in the forward part of the car.

As the car is now equipped letters can be cancelled just as fast as they can be fed to the machine. They can then be worked up for their respective routes, and it is expected that they can be delivered on an average an hour sooner than if they were taken to the sub-stations and handled in the old-fashioned way.

The roof of the interior of the car is painted a dead white. The sides and stamping tables are painted yellow. More space for hanging pouches is left in the interior than in the old cars. Assorting tables, two cases of pigeon holes, storage racks and all other apparatus for dispatching the work are in place. It is the intention of the authorities to have new cars run on schedule time. At certain points along the stated route of the car and at stated times the car will be met by collectors, who will turn their mail into the car instead of at the stations to which they are assigned. The mail will be cancelled and assorted on the car and left for immediate dispatch at the central office, or at some railway station.

It is intended to have these letters marked either by letters or figures on the cancellation stamp, so that every letter can be traced back to the locality from which it came.

## Telephone News From the Northwest.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

The Pierce County Telephone company of Ellsworth, Wis., has been incorporated with $3,000 capital stock.

The Iowa & Dakota Telephone company of Centerville, S. D., has incorporated with $25,000 capital stock.

C. W. Richards has applied for telephone franchises at New Richmond and Hudson, Wis., and if they are granted, connection will be made with Stillwater, Minn., and the Twin Cities.

The Blue Earth Valley Telephone company of Winnebago City, Minn., is considering putting in an exchange at Mapleton, Minn.

The new telephone company at Oshkosh, Wis., the Northwestern, will have its exchange in operation in a short time. It had expected to begin operations last month, but was delayed by the non-arrival of instruments. The company has 300 subscribers.

The Bell Telephone company is considering the rebuilding of its line from Negaunee to Palmer, Mich., putting in a metallic circuit, etc.

The new telephone exchange will be in operation at Baraboo, Wis., in a short time. The Standard instrument will be used.

The Wisconsin Telephone company is delayed in making connections with the Northwestern Telephone Exchange company in Minnesota, by the delay in the arrival of the cable to cross the Mississippi river. Should the river freeze before its arrival, a temporary line will be strung, giving long-distance connection between the Northwest and the East.

The Demopolis, Ala., telephone exchange, erected by Messrs. Toby Ely Max Ely and Monroe Meyer, was sold to N. L. Lee and E. B. McCarty on November 1st, and will be operated by these gentlemen, both of whom have experience in the telephone business Mr. McCarty is the president of the Marengo & Perry Telephone company. The Forkland telephone line also connects with the exchange. A local paper says: "If we ever had a useful and beneficial enterprise in our growing city, we think this telephone arrangement the best of all." G. W. Campbell is the electrician of the company.

## Incandescent Lamp Sockets.

The opinion of the United States Circuit Court of Appeals for the Second District, reviewing the decision of the lower court in the case of the Edison Electric Light company against the Electric Engineering & Supply company on patents covering incandescent lamp sockets, sustains the findings of the Circuit Court.

The suit was brought on five patents—viz., No. 265,311, to Edison; No. 251,596, to Johnson, and Nos. 257,277, 293,552 and 298,658, to Bergmann. All these patents relate to sockets for incandescent electric lamps. The patent to Edison, No. 265,311, was held valid by the Circuit Court and was also found to be infringed, but because of the expiration of a Russian patent to Edison for the same invention no injunction was granted. No appeal from that part of the decree was taken. The patent to Johnson, No. 251,596, was held by the Circuit Court to be invalid as to the claim in controversy. The complainant appealed; but upon the argument in this court the decree of the Circuit Court as to that patent was sustained on the opinion below. The third patent to Bergmann, No. 298,658, was withdrawn at the argument from the consideration of the Circuit Court, and from so much of the decree as dismissed the bill as to that patent no appeal was taken. The second patent to Bergmann, No. 293,552, was held valid by the Circuit Court, which decreed an injunction and accounting thereon. The defendant appealed; but upon the argument in this court the decree of the Circuit Court as to that patent was sustained on the opinion below. The first patent to Bergmann, No. 257,277, was held valid by the Circuit Court, as to the second claim, the only one of which infringement is charged. The defendant has appealed, and the determination of that appeal is the only question remaining to be decided by this court.

This first Bergmann patent is one for an improvement in the details of an incandescent lamp socket, devised to overcome a difficulty which was found to exist in the earlier combinations of lamp and sockets. The lamp, which comes separate from the socket, is a glass bulb surrounding the illuminating filament. Through the insulating material which closes the mouth of this bulb and constitutes its base run the leading-in wires which carry the current to the filament. Each of these leading-in wires is connected with a piece of metal on the outside of the lamp-base, these pieces of metal being separated from each other by insulating material. When the base of the bulb is inserted in the socket, these pieces of metal come into contact, respectively, with the two wires which bring the current from the source of supply. When both are thus in contact, the current flows through the filament. When one of them is cut off from contact by a key or other circuit-breaking device, the current ceases to flow and the light is extinguished. Prior to Bergmann's contrivance the two pieces of metal which connected at the lamp-base with the leading in wires consisted of a screw-threaded band around the base, near its lower end, and a broad flaring ring nearer to the bulb. The band engaged with screw-threaded metal in the socket, thus making electrical connection with one of the line wires. The flaring ring engaged with a like ring on the top of the socket, thus making connection with the other line wire. The insulating material of the base of the lamp, which formed a non-conducting body between the band and the flaring ring, was composed of plaster-of-paris. As the lamp-base was screwed down into the socket, so as to bring the two rings into proper contact, there was a constant tendency to pull the base apart between the screw-threaded band and the ring, and, as plaster-of-paris is a fragile material, it frequently happened that the insulating surface was cracked or disintegrated before the filament of the lamp was worn out. Bergmann reversed the position of these metal contacts in both lamp and socket. The screw-threaded band and its engaging thread on the socket were retained, but the rings nearer to the bulb were dispensed with. Instead of the flaring ring on the lamps he placed in the center of the base bottom a metal disk connecting with one of the leading-in wires. Instead of the ring on the top of the socket he placed a metal projection in the hollow space in the bottom of the socket, connected with one of the line wires and arranged so as to impinge upon the metal disk in the bottom of the lamp base when the latter was screwed into the socket. In consequence there was no longer any tendency to pull the insulating material apart. On the contrary, as the screw-thread drew the lamp base deeper into the socket pressure on the bottom plate increased and the insulating material was pressed closer together. The patentee in his specification sets out that the object he had in view was to "produce a socket for incandescing electric lamps which will have the electric terminals or contacts so constructed and arranged that terminals can be used on the base of the lamps, which, from their position, will subject the base to compression when it is screwed into the socket, instead of to tension, thus permitting the use of a moulded base without danger of cracking between the terminals."

The second claim, which is the only one in issue, is as follows:

2. In an electric socket, the combination, with the body of insulating material, of a plate in the bottom of the socket, and a horizontal screw ring located between the bottom plate and the mouth of the socket, said plate and ring engaging opposite parts of an entering base or plug, and serving to compress the base or plug between the terminals carried by it, substantially as set forth.

It is to be noted that in this patent, which is for the socket alone, only half of Bergmann's device is claimed. To its successful operation it was quite as essential that the old lamp-base should be remodeled as it was that the form of socket be changed. And the patentee testifies that when he perfected his device and showed it to Mr. Edison, in whose employ he then was, the latter at once gave instructions to the manager of the lamp factory to stop making the old-style lamp bases and to make them so as to compress the plaster when screwing the lamp in, instead of pulling it apart. The improvement is, no doubt, a small one; but it seems to be useful. The defect it remedied was a troublesome one, and, so far as the evidence shows, Bergmann's change of the relative position of the contacts seems to have overcome it. The various Edison companies at once began to use sockets with the contacts described and claimed in this patent, modifying the Edison lamps accordingly, and that construction became the standard construction for Edison's lamps and sockets, and has remained so down to the present day. For many years no one seems to have infringed, and it is only recently, when the business of electric lighting has grown to such dimensions that there is a profitable field for the manufacture of separate parts of the apparatus employed, that defendant has undertaken the manufacture of sockets suitable for operation with lamps having their contacts arranged as in the Edison, and which are infringements of the Bergmann patent. Several patents and publications have been introduced by defendant to show the prior state of the art and support the contention that the Bergmann device contains no element of patentable novelty. The Powell English patent of 1874 is the best of these references. None of the others are more suggestive than this. It is a device for an electric arc lamp and a standard or suspending or mural support for the same. It shows the lamp base or stock screwed into a supporting socket. The screw-ring provided one contact, and a spring-plate in the lower part of the hollow in the socket provided the other contact, with the result that pressure or compression would be applied to a more or less extent to the base.

Complainant's experts criticise the Powell patent as an anticipation by pointing out that it belongs to the art of arc lighting; that it is bulky; that it has never been found practically useful. The difficulty with it, however—and the same objection applies to all the other patents and illustrations introduced as anticipations—is that, although compression to a slight degree did result from screwing the lamp-stock down onto the spring-plate, such compression of the material of the stock between the screw-ring and the end of the stock was not in the contemplation of the patentee, or pointed out in the patent as an improvement, or in any way suggested as a function of the arrangement of the parts. Naturally enough the Powell patent was silent on this point, for it was a matter of no concern whether the lamp-stock was pushed or pulled. Its materials were, so far as the patent shows, tenacious and strong, and it made no difference to what strains they were subjected. The Powell patent suggests not the desirability of arranging strains so as to compress the insulating material of the lamp stock or base, but how to obtain such compression. It needed, however, no prior patent to instruct any one that if a screw-threaded plug with a projection on the end is screwed into a hole there will be compression of material between the screw-thread and the end of the plug as soon as the latter impinges on the bottom of the hole. The merit of Bergmann's invention consisted not in showing to the world that if you had a screw-thread on a lamp-base and a metal plate at the end of the base, with insulating material between screw-thread and plate, you would secure the compression of such insulating material when you screwed it into a socket till it touched bottom, but in finding out that the cracking and disintegration of the plaster-of-paris bases of the older lamps was occasioned by tensile strain between terminals, and that this particular difficulty could be overcome and the lamp's service improved by reversing the position of the terminals in both lamp and socket, so that the strain should be no longer tensile, but compressive.

The record discloses no anticipation, and as we are satisfied that the improvement, although slight, was useful, the decree of the Circuit Court as to this patent is affirmed. In view of the results of these cross-appeals, no costs of this court are allowed to either party.

## American Institute of Electrical Engineers.

At the regular monthly meeting of the council held at the rooms of the Institute, 26 Cortlandt street, November 20th, the following named associate members were elected: William D. Ball, Chicago, Ill; Eskil Berg, Schenectady, N. Y.; Charles L. Brown, Chicago, Ill.; Clinton C. Burr, Pittsburg, Pa.; Paul G. Burton, New York, N. Y.; Julian Du Bois, Albany, N. Y.; Eugene Friedlaender, Duquesne, Pa.; Clarence P. Gott, New York, N. Y.; Nevil Monroe Hopkins, Washington, D. C.; Albert S. Hubbard, New York, N. Y.; Ellicott Maccoun, Munhall, Pa.; Frederick William Phisterer, Ithaca, N. Y.; Erich Rathenau, Berlin, Germany; Alfred K. Warren, New York, N. Y.; Henry Storrs Webb, South Bethlehem, Pa.

The following named associate members were transferred to full membership: Arthur Hartwell, Pittsburg, Pa.; Julius Martin, Brooklyn, N. Y.; Joel W. Stearns, Jr., Denver, Col.; Maurice Oudin, Schenectady, N. Y.; Louis K. Comstock, Chicago, Ill.; Edward D. Brown, New York, N. Y.; Fred A. La Roche, New York, N. Y.; J. J. O'Connell, Chicago, Ill.; Frederick William Darlington, Philadelphia, Pa.; Frederick Valdemar Henshaw, Providence, R. I.

At the meeting of the Institute at 12 West Thirty-first street the evening was devoted to a consideration of the topic "Storage Battery Applications." Communications submitted by A. E. Childs and C. L. Edgar of Boston, F. B. Crocker and N. W. Perry of New York, and Carl Hering of Philadelphia formed the basis of the discussion, which was participated in by H. Ward Leonard, E. T. Birdsall, J. B. Entz, J. Appleton, C. Blizard, Townsend Wolcott, J. W. Lieb, Jr., and others. This was the first experience of the Institute in the line of topical discussions, and the result in New York was very gratifying. The attendance of members and guests was 115, and President Duncan deemed it advisable to call for an adjournment at 11 P. M. The subject was also discussed at Chicago and San Francisco the same evening.

## Use of Storage Batteries in Electric Lighting.[1]

By Dr. Francis B. Crocker.

The function of accumulators is to receive electrical energy at one time or place and to give it out at some other time or place.

The principal uses to which they may be put in electric lighting are the following:

1. To supply portable electric lamps.
2. To take up fluctuations and thus steady the voltage or current.
3. To furnish energy during certain hours of the day or night and enable the machinery to be stopped.
4. To aid the generating plant in carrying the heavier load which usually exists for only an hour or two.
5. To make the load on the engines more uniform by charging the battery when the load is light.
6. To transform from a higher to a lower potential by charging the cells in series and discharging them in parallel, or *vice versa*.
7. To subdivide the voltage and enable a three or a five-wire system to be operated with a single dynamo.
8. To supply current from local centers or sub-stations.

Each of these applications will be considered separately in the above order.

1. *Portable Accumulators.*—The accumulator is practically the only means of supplying portable electric lamps or those which are not connected to a dynamo even if they are stationary.

The primary battery is expensive and troublesome to operate, and it has never been commercially successful for electric lighting, except where only a few small lamps are required. Nor is there any other satisfactory primary source of electrical energy except the dynamo driven by mechanical power. It is therefore practically essential to adopt accumulators wherever portable electric lamps are used.

The serious drawback with portable accumulators is their great weight. For example, a standard size which weighs 100 pounds yields 10 volts and five amperes, or 50 watts for 10 hours, which is just sufficient to feed one ordinary incandescent lamp of 16 candle power. This weight would be prohibitive in most cases in which the only way to carry the battery was by hand, but it might be allowable for lighting railroad trains, where the weight would not be so objectionable.

Their great weight would also discourage in most instances the use of accumulators for supplying lamps in places which are not connected to a generating plant, the batteries being carried back and forth from a charging station. This method might be resorted to on special occasions, such as a fete, to which ordinary commercial limitations do not apply but for regular lighting it would be troublesome and expensive.

Small accumulators are used to feed miniature lamps for medical or dental purposes, in which case their weight is not a serious difficulty in view of the importance of the work and the small amount of energy required. Small batteries are also employed for theatrical lighting effects in which the lamps and batteries are carried by the performers when it is not convenient to supply lamps by a wire connection.

2. *Accumulators for Preventing Fluctuations*, due to unsteadiness in the driving power, are often applied successfully. A dynamo driven by a gas engine, for example, may vary periodically in speed because of the explosive action of the gas in the cylinder, and a battery connected in parallel with the dynamo will have the effect of steadying the voltage. But improvements in design and construction tend to reduce unsteadiness of speed and by the use of a heavy flywheel and an elastic connection between the engine and dynamo the result is sufficiently satisfactory in most cases to make a battery unnecessary. An accumulator is generally installed in connection with a small gas engine lighting plant to enable the engine to be stopped for a considerable portion of the time and thus save labor and attention, in which case the battery may also act to prevent fluctuations, but its principal function is the former one, which will be considered next.

A windmill electric lighting plant absolutely requires an accumulator or some other means of storing energy, not only to eliminate fluctuations in speed which are constantly occurring, but also to bridge over the considerable periods of calm weather.

3. *Accumulators to Enable Machinery to be Stopped* during certain portions of the day or night. The advantage of this application depends upon the fact that in almost every electric lighting plant there are long periods during the day and late at night when the number of lamps lighted is so small that it may not pay to run the generating machinery.

This plan also allows the machines to rest and cool down, which greatly facilitates cleaning and repair. In a hotel, residence, or on board of a yacht, it may also be very desirable to stop the machinery and avoid the vibration and noise during the night. On the other hand, the addition of an accumulator to an electrical plant renders the latter heterogeneous, since the battery and its management differ so radically from the machinery and the handling of the same. It must also be remembered that the total investment is increased by the cost of the battery and its accommodation because the generating plant is perfectly able to carry the load put upon the battery since, by hypothesis, this load is a light one. Hence the machinery might be run all the time, in which case the battery would be entirely unnecessary and sufficient rest for the machinery could be secured by using different machines for the periods of light load on successive days. These statements are based upon the supposition that the battery is not used to help the dynamos at the time of maximum load, since this case will now be considered separately.

4. *Accumulators to Aid in Carrying the Maximum Load.*—If accumulators are substituted for a certain portion of the dynamo capacity the question arises whether the substitution secures any advantage. In regard to first cost, authorities differ widely. These discrepancies probably arise from the confusion between kilowatt and kilowatt hour of output. Most accumulators have a normal time of discharge of about 10 hours, hence the cost per kilowatt hour is only one-tenth of the cost per kilowatt of output, and this would, of course, vary with any change in the time of discharge. In many cases it is specious and leads to mistakes to speak of kilowatt hours, to appreciate which fact we have only to realize that the kilowatt hour capacity of a dynamo is almost infinite since it might run for 20 years. The actual kilowatt of output, or in short how many lamps can be simultaneously fed, is the question in electric lighting. Moreover, in most cases, the time of discharge of an accumulator is unnecessarily long, and this is particularly true when it is used to help carry the heavy load, which usually lasts only one or two hours. In this case the remaining hours of available discharge are of little or no use. If it be attempted to discharge more rapidly, both the capacity and efficiency are reduced, and in many types the condition and very life of the battery are injuriously affected by a high rate of discharge. What is needed for the maximum load or "peak of the load diagram" is an accumulator with a normal time of discharge of two or three hours and having a correspondingly smaller first cost, bulk and weight, that is, about one-quarter of those of the ordinary forms of battery, but certain types of cell are capable of discharging at this rate. It is evident that the time of charging need not be made as short as that of discharging, if it happens to be more convenient to charge less rapidly.

The use of accumulators to enable the machinery to be stopped, which is a case already discussed, usually demands a time of discharge of from 10 to 14 hours, which agrees quite well with the normal discharge rate of the ordinary forms of battery, but even then the time is unnecessarily long, since the average rate of discharge would rarely exceed one-half of the maximum rate. Consequently the battery would either be incompletely discharged or the rate would have to be made excessive at certain times.

5. *Accumulators to Maintain Uniform Load on the Engines.*—Steam engines are very inefficient at light loads. This inefficiency, in fact, is one of the chief sources of loss in an electric lighting plant, and the principal object of the engineer who designs and operates a station should be to reduce this waste to a minimum. The accumulator is the most important means of accomplishing this result, although there are other methods, such as gas, thermal (hot water) and steam storage, all of which have been carefully compared by Nelson W. Perry in a paper before the National Electric Light association, February, 1895, "Storage of Energy Essential to Economy of Working Central Stations." Judicious selection of the number and sizes of the engines would enable them to be worked at a considerable fraction of their full capacity nearly all of the time, and it would seem that the same care that would be required to manage the battery might enable this to be accomplished. Nevertheless the accumulator gives more flexibility to the plant, and where introduced it often seems to considerably increase the economy of the engines by making their load more uniform and nearer their full capacity. According to the figures given by Mr. Perry in the paper cited, an electrical horse power costs $48.68 per annum when developed steadily, and costs $117.78 per annum with a variable load similar to that of an electric light station; that is, the latter costs about 2.4 times as much as the former. This ratio seems very high, but is borne out by statistics,[1] which give a very large coal consumption for most electric light stations.

Under these circumstances almost any method of making the engine loads more uniform should increase the economy of working. Doubtless an accumulator would benefit any plant in which an engine runs for any considerable portion of the time at less than half of its full power.

If a plant is so small that it contains only one engine, it may be necessary to run it a great deal of the time far below its full load. But even with two engines it is generally possible to select the sizes so that the smaller one runs economically during the periods of light load, the larger one alone is suited to medium loads and both are used for the maximum output, the times during which any engine is very much underloaded being very short. With a greater number of units it becomes still easier to properly apportion the load, and when there are five or more engines, as is usually the case in large stations, the loss from this cause should be trifling. To be sure the waste of energy which occurs from using boilers for variable loads still remains, but according to the figures given by Mr. Perry this is less than that due to the engines, and general experience shows this to be true.

6. *Accumulators Used as Transformers.*—If the cells of a battery are arranged in series while being charged and in parallel for discharging, a high voltage current will be required for charging and a low voltage current will be given out. The total amount of energy measured in watts is the same minus the loss of 15 or 20 per cent. which always occurs in accumulators. The result is similar to that obtained by an alternating current transformer or motor-dynamo. Such a method of transformation of potential might be employed in connection with long-distance transmission of energy, the current being sent over the line at high voltage and converted to low voltage by accumulators for local distribution. For potentials of several thousand volts, which are commonly employed in transmitting long distances, the number of cells required would be so great as to make this of doubtful practicability compared with the ordinary stationary or rotary transformers, but it would give uniformity in load and other advantages which may be secured by the storage of energy.

7. *Accumulators Used for Subdividing Voltage.*—This application is similar in principle to the preceding. The most important practical case is that in which a dynamo of 220 volts charges a battery of corresponding potential, a three-wire system being supplied from the battery, the neutral wire of which is connected to the middle point of the battery. This arrangement avoids the necessity of running two dynamos and allows the battery to be placed in a sub-station near the districts to be supplied, so that it is only necessary to run two conductors to that point instead of three. The same principle may be applied to the five-wire system.

8. *Accumulator Sub-stations.*—The plan of installing battery plants at local centers which are charged from the main station enables some of the conductors to be saved in a three or five-wire system, as already stated. It also makes it possible to reduce the size of these conductors because the current which flows over them can be kept practically constant, so that it is not necessary to have them large enough to carry the maximum current consumed by the lamps, which may be several times the average value. This, of course, gives the same steady load on the generating machinery as if the battery were located near it.

The batteries at the various sub-stations may be connected and charged in series or in parallel. The former plan is similar to case 6, and would require far less copper in the conductors, since the voltage is multiplied by the number of batteries in series and the current is the same as for a single battery. On the other hand, this high difference of potential would exist between the first and the last batteries of the series, and if either of them became grounded, any person connected to the earth and touching a wire supplied by the other battery would receive a shock due to the total voltage. This would demand that the maximum difference of potential should not exceed 500 volts, or, in other words, four batteries of 110 to 125 volts each might be charged in series and could be connected to the lamp circuits at the same time. This would practically amount to a five-wire system using accumulators to subdivide the potential as explained in case 7. If the batteries were entirely disconnected from the lamp circuits while being charged, the latter would be free from danger of the high pressure, which might therefore be 1,000 or 2,000 volts if desired, the batteries being charged during the day and supplying the lamps at night. For continuous working, two batteries would be necessary. Accumulator sub stations not only save copper in the feeders but also reduce the cost of and lost voltage in the distributing conductors because the batteries can be placed near the lamps to be supplied with current.

*Accumulators Used for Two or More of the Above Named Purposes.*—Each of the different uses of the storage battery has been considered separately to avoid the confusion with which this subject is often beset, but as a matter of fact the employment of the accumulator for several of these purposes is the most common practice. By thus combining these different applications the plant may be rendered not only more economical but also much more flexible. For example, the battery may be utilized to help out the generating machinery at times of heavy load or when the latter is partially or wholly disabled. It often happens that it is difficult to produce or maintain sufficient steam pressure owing to poor draught or other circumstances, in which event a battery enables the boilers to be temporarily relieved of some or all of the drain upon them while the pressure is being raised to the proper point. It may also be necessary or desirable to shut down the machinery or a portion of it for a few minutes to make some repair, adjustment or change of arrangement, connection, etc.

It is also possible to feed some of the circuits from the battery while the others may be supplied at a higher or lower voltage by the machinery. In these and many other ways an accumulator may be a very convenient adjunct to an electric lighting system. The fact that it is so radically different from the machinery in its nature and action makes it very unlikely that the entire plant will be crippled at any one time, since the two sources of current are not exposed to the same dangers. An accident to the steam piping, for instance, might shut down all of the machinery, but it probably would not affect the battery, and, *vice versa*, an accident to the latter is not likely to extend to the former.

[1] Communication presented at the meeting of the American Institute of Electrical Engineers, November 20, 1895.

[1] See Report of Committee on Data to National Electric Light Association, 1895.

## Electric Railway Development in Southern Chicago.

Referring to the recent blanket franchises giving to the Calumet Electric Railway company the right to extend its tracks over about 16 miles of streets in the southern end of Chicago, John Farson, the president of the company, says: "We will put a line or part of a line on every street on which our franchises give us the right to build. We haven't grabbed the whole South Side, as some people seem to suppose, and the streets that have been given up for car line purposes don't amount to enough to cause all the howl that has been made about them. For instance, I want to build a branch to connect our Seventy-fifth street line with the Alley 'L' at Sixty-third street. That's a short distance, north and south, but in order to traverse it we have to use three streets. We will come up from Seventy-fifth street on St. Lawrence to Sixty-sixth, and then turn over west a block or so to South Park avenue, on which we will connect with the elevated. Our franchise for that short line reads over three streets, and it reads as though we had grabbed them all. But we haven't. We simply want to connect our Seventy-fifth street line with the elevated, and that is the easiest way to do it. We haven't grabbed three whole streets, but we have to use parts of three to come twelve blocks. I claim that we are doing more to develop that part of the country than the churches. We are operating our lines there now at a loss and have been for some time. Anyone who knows anything of that part of the map must understand that we are banking on the future entirely. But see what we will be able to do when our new lines are built. We will carry passengers for one fare from West Pullman to South Chicago, to Windsor Park and the lake or to the elevated at Sixty-third street. By means of

our new connection with the elevated at Sixty-third street and South Park avenue we will take passengers from downtown to any of those south points along the lake and over to Kensington and West Pullman for 10 cents. We will tap all that country down that way and enable the people who live there to get from almost anywhere to anywhere else."

## How to Make the Business Paper Pay the Advertiser.

By N. C. Fowler, Jr.

Advertising to pay must be made to pay. The good of all good is in so handling the good that the good of it does good. Poor advertising pays poorly; good advertising pays well. Good goods and poor advertising may be as profitless as bad goods and good advertising Unless the quality of the goods and the quality of the advertising harmonize, there is no profit in publicity, except that transient profit that no decent man cares about.

The conventional advertisement has a value, although it has looked backward over a quarter of a century. The selling value of anything is partly in the appearance of it. Intrinsic value, covered with a bushel basket, is no more salable, and perhaps not so salable, as less value well presented. A ham sandwich, with a wide, thick table-cloth and napkin as big as a towel, with a waiter of immaculate blackness, and a well-set table, is more appetizing than terrapin and game served in a horse trough. The diamond is not more brilliant than coal before it is polished.

Make the goods look as well as they are, provided they are as well as they look. Make the advertisement look as well as the goods.

The advertisement which reads—

John Smith,
Manufacturer of
Electrical Machinery and Supplies,

may bring Mr. Smith some business, but it will not bring him the business that is sure to come from an advertisement which advertises what Mr. Smith sells more prominently than Mr. Smith himself. Mr. Smith is not for sale; that which he makes is for sale. The buyer cares nothing about Mr. Smith beyond Mr. Smith's reliability and character. He cares everything about the quality of what Mr. Smith makes. I do not deprecate the value of keeping Mr. Smith's name before the public, but I do not believe in advertising Mr. Smith to the prejudice of what Mr. Smith makes.

Three-quarters of the advertisement, and the largest type, should be used in announcing the articles manufactured. Too big type cannot be used—the bigger the better. Better hit the pocket-book of one man than the feet of a dozen. One word inside of a man is worth 100 outside of him.

No matter what you sell, advertise it, with your name and address as a matter of necessity, but don't place your name at the top of the advertisement in the largest type, followed by a conglomeration of what you make so mixed up and so insignificant that one can't separate the wheat from the chaff.

If you manufacture a dozen articles, don't conspicuously speak of more than one of them at a time unless you have separate advertisements for each.

There is no objection to advertising some one article prominently, and in small type following speak of the other lines carried.

Let the advertisement have the advantage of always profitable oneness. Let it appeal to the buyer on some one particular thing, that thing to be changed to another in the next issue of the paper, if you make other things. If you manufacture a dozen articles advertise one prominently, with the others very much less prominently; then the next time advertise another prominently, and the other less prominently, and so on.

Don't say much in your advertisement. It is not the business of the advertisement to sell goods. It is to assist your salesmen and your catalogue in selling. It is the business of the advertisement to create correspondence, to separate the probable from the possible customers, to bring into your office letters which indicate that certain people desire certain goods, and it is then your business and the business of your employes to sell them.

Trade paper advertising would be worth double what it is to the advertiser if the advertiser made his advertisements specify something in particular, not everything in general. Make one point at a time, and only one. Advertise prominently the thing for sale, not the seller of it.

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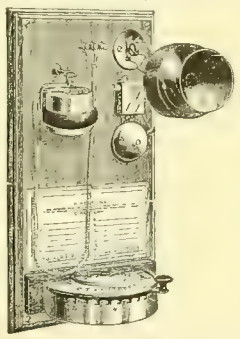
Twelve hundred horses are said to have found themselves out of employment when the first electric car went over Twelfth street from West Fortieth to Halsted street, Chicago. At Halsted street the new trolley car was hitched to a Halsted street cable train and made the trip to the business district via the Blue Island tunnel and loop. This is the route all trolley cars on the Twelfth street line will follow.

## The "Auto-telephone" System.

Owners of hotels, business houses, factories, and in fact almost everybody, realize the necessity of a simple and perfect means of intercommunication. With this idea the auto-telephone has been perfected, and is now being introduced in Chicago and Northern Illinois by Richards & Meacham, 84 and 86 La Salle street, Chicago. The system admits of complete intercommunication. What is true of telephone service between business houses is equally true of service between the several departments in any one business house. By means of this system the proprietor may consult and give directions to his clerks and department managers. They, in turn, may give directions to or hear reports from the sub-departments. The necessity of going to various departments is obviated; the errors and cost of messengers are eliminated; and, not least in importance, the respective superintendents or foremen may report to and receive direction from superiors, and yet have their people always under observation. When desired it may be arranged so that certain stations only can call a given station, although the station is in such relation to the system as to permit calling all the others.

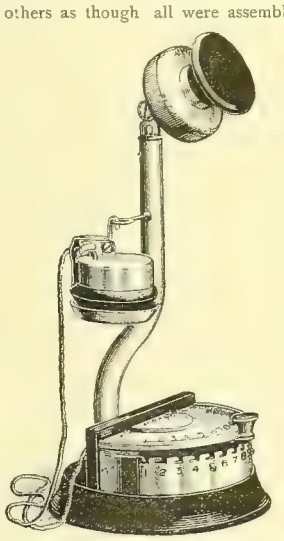
The system is readily understood and can be operated by inexperienced persons. It is practically automatic. It



THE "AUTO TELEPHONE" SYSTEM.

employs but one hand in operating, leaving the other free for writing. The receiver may be hung up or placed on its own base as desired. It is impossible to leave the circuit closed through forgetfulness, for the reason that warning signals will ring continuously when the receiver is laid aside, unless the circuit is opened by releasing the signal key. When a call is made for any outlying station instant notice is given, automatically, as soon as the receiver of such station is taken in hand, doing away with the necessity of repeatedly placing the receiver to the ear to ascertain if the call has been heard.

The signals operate at both the station "calling" and the station "called," insuring that the circuits are in order. They do not ring up or disturb any other stations, but if desired a conference may be had between the several departments without the necessity of leaving the desk, each hearing the others as though all were assembled in the

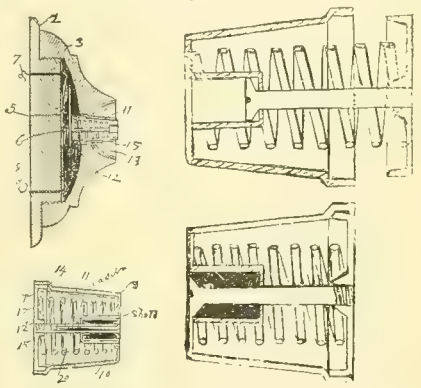


THE "AUTO-TELEPHONE" SYSTEM.

same room. The auto-telephone system can be used for hotel work in connection with an ordinary hotel annunciator, and on the same wire used for the call-bell system, thereby largely reducing the operating expenses; first, by having the rooms in direct communication with the office, and thereby decreasing the number of hall boys necessary; and secondly, by the saving of time in communicating between the different apartments of the hotel. In apartment buildings the system may be so arranged that each apartment may be put in communication with the janitor and all other apartments.

## Combined Push-button and Thermostat.

The accompanying cuts give a fair representation of a push-button and fire alarm thermostat that the Liberty Electric company of New York is placing on the market. This small but ingenious and effective invention possesses considerable merit. It consists of a piece of mechanism placed inside the call-button in each room and answers the double purpose of call-button and fire alarm. It is constructed on scientific principles to the extent that it will



COMBINED PUSH-BUTTON AND THERMOSTAT.

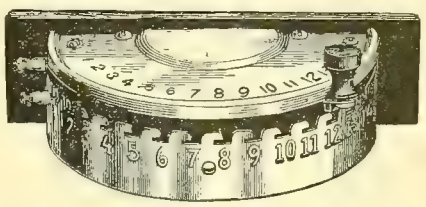
withstand any amount of reasonable abuse, and at the same time the alloy will melt at the low temperature of 150° Fahrenheit.

The "button" has been on the market for about four years and has met with no small degree of success. The present agents propose to push the invention for universal adoption. Coming, as it does, highly indorsed by those who have taken the pains to thoroughly test its utility, it is reasonable to suppose that the public will take kindly to its introduction, as it offers additional security to life and property.

## Telephone Service for Fifty Cents a Month.

In Janesville, Wis., a new telephone company is in the field with a proposition that involves the operation of an exchange of 300 instruments on an annual income of $1,800. The *Gazette* of that place states that this proposition is being laid before the business men:

Their plan contemplates the establishing of an exchange



THE "AUTO-TELEPHONE" SYSTEM.

of at least 300 subscribers. Each subscriber of that number will buy a share of the stock in the company, at $50 a share. He then gets his telephone for 50 cents a month, or $6 a year. Under this arrangement, the subscribers will get the instrument that now costs him $36 per annum for $6, the $30 difference representing the interest, so to speak, on his $50 investment. When the 300 original subscribers are secured, the exchange will be started, and after that, the stockholders will also get their pro rata of profit on each new subscriber, in addition to the cheap telephone.

The mechanical arrangements are in charge of an expert electrical engineer, and the company making the proposition is the Western Telephone Construction company, the organization which was noted in the *Gazette* some days ago. The company has been incorporated with a capital stock of $5,000, and proposes to push the work aggressively.

## Consolidation of Philadelphia Lighting Companies.

The practical absorption of the Edison Electric Light company by the Pennsylvania Light, Heat & Power company is believed to mean ultimately the consolidation of all the illuminating interests of Philadelphia. Now that the start has been made, and that the largest electric light company in the city has surrendered its individuality, the rest is believed to be easy, says the *Evening Bulletin*.

As matters stand the Pennsylvania Light, Heat & Power company practically controls for these important purposes all of the territory lying between Girard avenue and South street and between the two rivers. Within these boundaries lie the very heart of the city. Within these limits there now remains but one independent illuminating company—the Brush Electric Light—and as this is practically controlled by capitalists who have interests closely allied to the consolidation movement, that corporation is looked upon as the next to join the monopoly.

Besides the Brush there are six other electric light companies in Philadelphia—all occupying territory west of the Schuylkill and north of Girard avenue. These companies have a monopoly of commercial and domestic lighting in their respective localities, and, by a joint agreement, do the

city lighting upon a basis that precludes competition and insures large profits. The consolidation of all these companies under one management, actuated by a single policy, would logically mean, through consequent economies, still greater returns. The same principle that is being followed by the Union Traction management will, it is believed, be pursued by the Pennsylvania Light, Heat & Power company—concentration of authority and power and a lopping off of all unnecessary expenses. It is not likely that there will be any lowering of rates.

## CORRESPONDENCE.

### New York Notes.

NEW YORK, November 23.—The plans of the Rapid Transit Commission appear to be in a fair way to be realized. The General Term of the Supreme Court has granted the application of the board for the appointment of three commissioners to determine if the rapid transit roads shall be built notwitstanding the fact that the board has been unable to procure the requisite consents of property owners. The objection raised by Franklin Bartlett and George Zabriskie in behalf of property owners, striking at the constitutionality of the Rapid Transit acts, are to stand over. The court says: "We think that all the questions which have been raised on this application should wait for the final disposition and report of the commission to be appointed. The court will enter an order appointing commissioners, in which shall be reserved all the right of the parties who have appeared, to be heard upon the coming in of the report upon the objections which have been presented on this application." Mr. Zabriskie, in his argument, asserted that the commissioners were dallying with the public. There is reason to believe that there will be active competition for the franchise of the underground railroad laid out by the commission when the franchise is put up at auction. William Steinway said of this phase of the matter: "There will undoubtedly be a strong and determined competition for the franchise from large moneyed interests. The inquiries received by the commission and other knowledge on the subject which I possess show this unmistakably. It seems that railroad men and heavy interests have come to the conclusion not only that the road will be built, but that it will be the key to the whole problem of transportation in the city." It is stated that the Metropolitan Traction company will be one of the bidders, if not directly, then through middlemen. An interested capitalist said: "The high price which the Metropolitan ran up on its bid for the Kingsbridge route showed that it wanted no rival corporation to run its lines over the proposed underground route. You will find that the Metropolitan will secure the underground franchise if it can be done, since all its surface lines would be feeders to and distributers from the rapid transit lines."

The striking housesmiths caused the electric lights to be cut off on several large jobs of J. B. & J. M. Cornell and Milliken Brothers, so that work cannot be carried on at night. The electric current was shut off on the immense building of Seigel, Cooper & Co., at Sixth avenue and Nineteenth street, the Hotel Waldorf annex at Fifth avenue and Thirty-fourth street and two or three other structures, because non-union men were employed on them.

W. F. O.

### Milwaukee, Wis.

MILWAUKEE, November 23.—Never in its history has the Wisconsin Telephone company been fought by its patrons so systematically and generally as it is being fought at the present time. The cry is lower rates and better service. An association comprising more than half of the Milwaukee subscribers has been organized and every effort is being made to compel the company to amend its rules and to reduce its rates. The company now limits its subscribers to 1,000 calls a year at the regular rates and charges two cents a call for all business in excess of 1,000 a year. Thus, a subscriber who pays $75 a year, which is at the rate of 7½ cents a call, must pay two cents for every call in excess of his allowance of 1,000 a year. Settlements are made quarterly. It was urged at a preliminary meeting of attorneys and business men, held a short time ago, that the Wisconsin Telephone company had for some time been endeavoring to establish in Milwaukee the same rates that prevail in Chicago and other large cities like Chicago. It is argued that while the necessity for telephones in Milwaukee is greater than three calls a day, it does not warrant the charging of such rates as prevail in Chicago, and it was asserted furthermore that the service here does not warrant higher rates than from $50 to $90 a year, according to the character of the business for which the telephone is used, and that these figures ought to include the unlimited use of the telephone. "It is a very small business house," said one subscriber "that can get along with three calls a day. It must pay two cents extra for every additional call. The Wisconsin Telephone company informs us that in Chicago the rates run from $150 to $200 a year for business telephones, but the company is glad to get a rate of $25 a year in many towns in Wisconsin, such as Portage, Waukesha and other points, and it is just as fair to compare these rates to Milwaukee rates as it is to compare Milwaukee rates to Chicago rates." The charge is made that the recent reduction in telephone rates was really no reduction at all, for while the company reduced the rental of an ordinary business telephone from $90 to $75 a year, it added "extras" in most cases that brought up its quarterly bills to about the former standard. In many cases, it is stated, the bill for extra calls exceeded the amount of the regular rental. The Milwaukee Telephone Users' association has been formed by telephone subscribers, the officers consisting of a president, a vice-president, a secretary and a treasurer, the president, or in his absence, the vice-president, to appoint an executive committee of five, which appointment shall be ratified by the members of the association. It was provided in the agreement that it should take effect as soon as it had been signed by 250 subscribers, and it was to be ratified and changed if necessary as soon as 1,000 users of telephones in Milwaukee had signed it. It was stipulated that each firm or person or company signing the agreement should pay to the treasurer the sum of $1 and should also pay annual dues not exceeding $1. The money derived in this manner, it was provided, was to be spent in investigating the workings of the telephone system and in getting relief from burdensome charges and inefficient service. A committee consisting of Frank M. Hoyt, W. H. Timlin, E. H. Bottum, Frederick Kraus, Julius Wechselberg, A. K. Hamilton, Emil Durr, Henry Niedecken and George W. Ogden was appointed to circulate the agreement and get additional signatures. Mr. Bottum stated at the meeting that an investigation had been made of the earnings and business of the Wisconsin Telephone company and that it had been ascertained at the office of the secretary of state at Madison that the company's gross earnings for the past fiscal year amounted to $421,233.73. The company's gross earnings for the past eleven years, it was stated, amounted to $3,385.000, and the assertion was made that the company could cut the present rates in two and still pay a handsome dividend. The capital stock of the company, it appears, is $1,000,000, but it is stated that only about half of this sum has been invested in Milwaukee. Some of the subscribers claim that with the present charges for additional calls their telephone bills will reach $160 a year. The Milwaukee Liverymen's association has decided to join the Telephone Users' association in a body. A conference between the committee on organization of the Telephone Users' association and the officers of the Wisconsin Telephone company was held a few days ago and it was decided to refer the points in controversy to a special committee of five from each organization. It appears that the committee from the association called upon the company and asked that it be furnished with information as to the basis of the charges made by the company. The representatives of the company stated that the matter was one which could not be easily handled by so large a committee, and as a result a committee of five from each organization was appointed and a date was set for a meeting, when the necessary figures and other information were to be furnished by the company. The company, so its representatives stated, would go as far into the matter of its operations as its duty to itself as a corporation would permit. Its representatives would not bind themselves as to what it would make public and what it would consider none of the public's business. Some of the subscribers were of the opinion that the extra charges would be held in abeyance meanwhile, but a director of the company said that no such agreement had been made.

Just as proceedings to take the Milwaukee Street Railway company out of the hands of receivers appear to be likely to be taken in the United States court, steps to appoint another receiver are being taken in the state courts. In the Superior Court counsel for Dr. Herman C. Block, who had obtained a judgment for $3,500 against the company on account of personal injuries, asked the judge to appoint a receiver for the property, alleging that the United States court receivership was simply a scheme to avoid the payment of judgments aggregating about $100,000, obtained in various actions in the United States court. It was also proposed to show that the receivership was decided upon partly as a result of an impending strike. After they had begun proceedings in the Superior Court, however, the attorneys for Dr. Block discovered that that court had no jurisdiction, the amount of the company's property exceeding $5,000,000, which is the limit of the Superior Court's jurisdiction. Before this development had occurred, however, Block's attorneys had been summoned to appear in the United States court and show cause why they should not be enjoined from proceeding with the applications for the appointment of a receiver by the state court. An injunction by the federal court soon followed. Block and his attorneys were restrained from taking possession of the street railway or from commencing any suit or motion to interfere with the title or possession of the present receivers, Henry C. Payne and George R. Sheldon, except upon leave of the United States court. The Block people, however, were allowed by the United States court to bring suit against the company or against its stockholders so long as such suit did not interfere with the possession or title of the receivers. Then followed the development regarding the jurisdiction of the Superior Court. Judge Jenkins afterward modified the injunction so that it provided merely that the attorneys for Block should not attempt in any way to interfere with the property in which the receivers were then in possession. The Block suit was transferred from the state Superior Court to the state Circuit Court, and the attempt to have a receiver appointed was renewed. The liability of the stockholders is what the attorneys for Block are trying to get at. They also claim that the balance of a large amount of the capital stock of the company has never been paid, and that the balance is subject to attack. They also assert that a large block of bonds was deposited as security at the valuation of 33 per cent., and that the difference between that valuation and the real valuation is liable to seizure. The Block suit is now pending in the state Circuit Court. Two other judgment creditors, John Archer, who got a verdict for $5,000 for personal injuries, and Robert Stephen, who got a verdict for $9,000, have begun proceedings in the state Circuit Court for the appointment of a receiver for the West Side Railway company, which is part of the Milwaukee Street Railway company's system. It was upon the West Side railway that the accidents which resulted in the Archer and Stephen verdicts occurred. The plaintiffs aver that the West Side Railway company owns in this city a power house, roadbed and tracks, trolley wires, cars, etc.; that the company is insolvent, and that unless restrained by the court it will proceed to dispose of its property for the purpose of defrauding its creditors. Washington Becker, the banker, is made a party defendant to the suit, the plaintiffs averring that he is largely indebted to the company for unpaid subscriptions to its capital stock.

The Fond du Lac Light, Power & Railway company's plant is involved in a peculiar litigation. The property has been sold by Elihu Colman, ex-United States district attorney, to H. F. Whitcomb of Milwaukee, manager of the Wisconsin Central Railway company. W. G. Decelle, who has had the management of the light and power plant, has brought suit to restrain Messrs. Colman and Whitcomb, the First National Bank of Chicago and the St. Paul Trust company from taking further action affecting the title or the possession of the property. Decelle's complaint is sensational. It sets forth that pending the sale of the plant by the sheriff in December, 1894, Decelle, who was president of the company, and Elihu Colman, who was his attorney, unlawfully conspired together with the intent and for the purposes of acquiring title to the property adverse and hostile to the company and to the creditors of the company; that in furtherance of said conspiracy, Colman signed the name of his firm to papers in such action, entered a pretended appearance in said case for the St. Paul Trust company, and fraudulently and in violation of his duties to the court neglected to interpose any answer in said action in behalf of the Trust company. Decelle also alleges that he himself induced the Common Council to cancel the city contract for electric lighting, which was worth several thousand dollars and had three years to run, and that he and Colman entered into a new contract with the Common Council upon substantially the same terms as those which were contained in the old contract, and that the council also granted to Colman, who was the purchaser of the plant at sheriff's sale, the right to use the streets and alleys of the city for stretching electric wires, this franchise to run for 30 years. The Edison General Electric company has taken a hand in the fight, seizing on an execution a number of lamps and some machinery. Transformers have been seized and the company reduced to extremity. According to the latest advices the Fort Wayne company was expected to ship some lamps and machinery to the Fond du Lac people. The General Electric company, before seizing any of the property, made a proposition to Mr. Colman, which he refused to accept, and the representative of the General company was thereupon ordered to get possession of all the supplies furnished by the General company. To make matters worse the Fond du Lac Gas company was not equal to the demand made upon it, and the city has been threatened with darkness.

The report comes from Madison, the capital of the state, that William T. Fish and H. C. Adams, the latter state dairy and food commisioner, have obtained a franchise from the town board of Madison for the construction of an electric railway from Camp Randall to Wingra Park, thence to Greenbush and thence back to the city, connecting with the present line near the Illinois Central railroad station. The length of the new line is something over two miles.

C.

## PERSONAL.

J. S. Speer, secretary of the Partridge Carbon company, Sandusky, Ohio, was a Chicago visitor last week, looking after the interests of the Partridge brush.

W. Putnam Freeman, manager of the hard rubber department of the Newton Rubber company, is spending some days in Chicago after an extended trip to the Pacific coast.

Henry Sachs, late manager of the Beacon Lamp company, is now manager of the Cole & Gerald Manufacturing company of 145 Massachusetts avenue, Boston, which manufactures bicycles and bicycle supplies.

George P. Nichols read a paper on "Application of Electric Power to Industrial Purposes" before the Western Society of Engineers at Armour Institute, Chicago, on November 21st. The paper was non-technical in character, but it elicted an interesting discussion.

## ELECTRIC LIGHTING.

The town of Nappanee, Ind., has purchased the electric light plant at that place of W. H. McIntyre of Auburn, Ind., for $8,000.

The Chemung Gas & Electric Light company of Elmira, N. Y., has been incorporated with a capital of $200 000. The directors are. Charles G. Thomas, Arthur S. Pinkham, Paul Schaffer, Frank McKelvey and others of New York city.

The Mutual Electric Light & Power company of Chicago has made an assignment to Randall W. Burns. The franchise of the company and its plant are at Brainard, Ill., where it began business about three years ago. The cause of the failure is not given, but a statement was filed to the effect that the assets were about $25,000 and liabilities a like amount. The company has not received the patronage it expected when it was organized and was unable to meet its liabilities. Brainard is a small town near Washington Heights, on the Rock Island railroad.

## ELECTRIC RAILWAYS.

The Market Street Railroad company of San Francisco will begin at once the construction of its electric line from Mission street to Ingleside.

Over $15,000 has been subscribed outside the city for the promotion of the proposed electric railway at Saratoga, Cal. The Board of Trade committee is now assured of success.

At the election held November 19th the franchise for an electric road in Fenton, Mich., was granted to John E. Nolan of Saginaw. Mr. Nolan says the road between Flint and Fenton will be in operation next summer.

The Ft. Wayne Consolidated Railway company has been incorporated with a capital stock of $2.000,000. The directors are John H. Bass, M. S. Robinson, James M. Barrett, John J. Shepherd, Andrew Squire, Charles Gerke and Samuel L. Morris. The company will operate the electric street system of Ft. Wayne, Ind.

Through Percy Thompson & Co., investment bankers of New York, the Central Wisconsin Electric Railway company has finally completed the financial arrangements necessary for the immediate building of the road. The company will build at once 26 miles of road in the city of Oshkosh and 16 miles of interurban line, all equipped with electricity. The company's bonds for $1,000,000 and a loan of $450,000 have been secured by Percy Thompson & Co. and Charles E. W. Smith, and work has already been begun.

By February 1st, if not sooner, the Lake Street 'L" road of Chicago will be running with full electric equipment. Work is already well advanced. Thirty-five of the present smoking cars are being equipped with motors, and other cars have been ordered. The system will differ from that employed on the Metropolitan line in two particulars. Gear wheels of compressed rawhide instead of steel will be used in the machinery, to do away with the "roar" that is an unpleasant feature of travel on the present electric "L" road. The third rail will be carried in a conduit, instead of being entirely exposed as on the Metropolitan. This will prevent the great number of accidents resulting from workmen touching the rail. So many of the employes have been forced from their work by burned hands from this source of danger that a ruling is now in force that any man receiving such an injury is to be discharged at once. This seems harsh, but was found necessary as a means to inculcate habits of caution. The use of a conduit will largely overcome this disability.

## MISCELLANEOUS.

A new departure seems to be indicated by the name of the Philadelphia Electric Storage Battery Renting company, which has been capitalized at $300,000, of which $1,000 is paid in.

"I know there are many ways of telling a person's character," an elevator man in a swell New York flat is reported to have said, "but I have observed in my experience with the majority of people a peculiar method of telling a man's character. Now, for instance, the ringing of the elevator bell will suffice to instruct me of the character of the man. Should I be at the top of the house and receive a ring from down stairs I can immediately tell from the nature of the ring the sort of person I shall confront on my descent. Should the ring be very light I know that the person is a mild mannered, good natured, whole souled individual, whom I am only too anxious to oblige, but should the ring be a furious one then I conclude that the person is an impatient, peevish or hot tempered person, more furious than his ring, and with whom I take my time in answering. With women it is the same thing; a mild mannered woman will merely touch the bell, while the hot tempered creature will keep up a continual ringing until you descend and will then proceed to upbraid you for not hurrying."

A story is going the rounds of how an insolent conductor on a line of trolley cars that runs from Seattle along the shore of Green Lake got a setback the other day that was as effective as novel. He was a powerful fellow, and had long had a reputation for his impertinence and bullying manners. On this trip he declined to notice the signals of several women, and carried them far beyond where they wanted to go. A stalwart young fellow remonstrated, and the conductor threatened to punch his nose. The young man reached for the bell rope, stopped the car, grabbed the conductor by the waist, and threw him off the platform into the lake. The conductor crawled out sputtering threats, and was promptly punched back again as soon as he stood upright on the bank. Three times he crawled out and each time was punched back again into the lake. The fourth time he stood up in the water and asked permission to come out, promising good behavior.

The United States Patent Office is soliciting from domestic and foreign manufacturers, for the library of the Patent Office, copies of illustrated catalogues, price-lists, circulars and other publications. In many cases, where no illustrations are given, such lists and catalogues are of great service in determining the meaning of words used in the arts and for other purposes. It would seem particularly appropriate that the library of the Patent Office should be made a place of deposit for this unrecorded literature of the arts, which would otherwise in a few years be lost. Some of the most valuable books in the library are such lists, some of them more than 70 years old. That such a means of preserving for all time pamphlets of this sort is offered should alone be an inducement to all interested to aid in making this collection as complete as possible. Three copies in general should be sent, one for permanent deposit in the library, and two or more for the use of examiners, but all of them to belong to the library, and to be in charge of the librarian. When successive edititions are published, each new one should be sent direct to the Library, United States Patent Office, Washington, D. C.

A movement is under way to establish in New York a permanent commercial museum. A company has been organized under the name of the International Permanent Exposition company, including in its board of directors a number of well-known merchants. The company will not undertake to do any selling or commission business, but the intention is to secure specimens of the production of different countries with a library of information as to the industry, climate and soil of different countries, the habits of their people, and particulars as to currency, weights, measures, etc. Technical works on the principal industries of the world, technical dictionaries and similar works will also be collected and kept in the library with official returns, reports of foreign countries and similar matter. A bureau of information is also to be established which will collect and compile information with relation to our foreign commerce and give such aid as it can to the development of trade with other countries. Arrangements will also be made to collect detailed information concerning commercial opportunities and the demand for certified products in given localities. It is stated that already a large number of firms in different parts of the country have promised their assistance and adhesion.

## TRADE NEWS.

The Chicago office of the Electric Storage Battery company, in charge of C. W. Woodward, will be removed from 309 Dearborn street to 1543 and 1544 Marquette building on December 10th.

The cheap excursion rate to New York city via the Nickel Plate road, only $18 for the round trip, is good to return for 10 days. Sleeping car berths may be reserved in advance by addressing J. Y. Calahan, general agent, 111 Adams street, Chicago.

J. M. Atkinson & Co., 1439 Monadnock block, have been appointed Chicago agents for the Partridge carbon. The sales for this well-known brush, which has become in general use throughout the West, are rapidly increasing, and it is expected that the new Chicago agents will, in a large measure, add to its popularity.

The Lafayette Engineering & Electric Works, manufacturers of dynamos, motors, etc., has arranged with the Mason Electric Equipment company, 307 Dearborn street, Chicago, for the agency of its product. The company claims great efficiency for its apparatus and is prepared with prices and guarantees to meet the closest competition.

The *Columbus Lantern* of November 6th says: "The disposition of manufacturers of electrical apparatus to be well represented at the Ohio State University is typified in the recent action of the Standard Electric company of Chicago. A year ago last May a 20 light arc dynamo was made especially for us from the latest designs. Since that time the company has improved the regulating apparatus used on the machine, and has sent without expense to us the entire set of new parts necessary to adapt this new method of regulating to the old machine."

The Tucker Electrical Construction company, 1420 Whitehall street, New York, issues a neat and compact catalogue of its auto-telephone system and other specialties. The auto-telephone system is said to be ideal for inter-communication. It is very flexible. When desired it may be arranged so that certain stations only can call a given station, although the latter station is in such relation to the system as to permit calling all of the others. The auto-telephone system admits of complete intercommunication, each in position to call any other, or it may be limited as noted. The Chicago agents are Richards & Meacham of 86 La Salle street.

In a report to Chauncey M. Depew of the New York Central railroad, on the work of the Gordon battery on the Harlem division of that road, W. M. Kinch says: "The work required of batteries for automatic signals, particularly in the immediate vicinity of Mott Haven, where these are in use, is the severest test a battery can be put to, owing to the short blocks and congested traffic; in reality the track batteries, 18 hours out of the 24, are on a short circuit, and when I state that one set of Gordon, three cells, stood up under the strain for 43 days without any attention whatever, the showing is a remarkable one. In the same circuit three cells of gravity required attention within at least 10 days. I do not mean to convey by this the idea that the gravity cells became entirely exhausted at the expiration of that time, but they required the attention of the battery men to perform some service, such as cleaning zincs, drawing off solution or adding blue vitriol. The same results were obtained from cells working on two local circuits, another set on a crossing bell circuit, and still another on a telegraph line circuit."

The Gates Electric Manufacturing company has received propositions from the cities of Elkhart, Ind., and Goshen, Ind., to build a brick factory two stories high, 75 by 200 feet, with out-buildings, giving ground 150 by 300 feet, and also to put in side tracks, provided the company will move its plant to either of these towns. The business has extended, and other propositions looking to the securing of better shipping facilities are under consideration. This company reports the sale of a complete electric light plant for the United States Insane Asylum at Phœnix, Ariz. This plant will comprise one 25 kilowatt multipolar generator, with handsome slate switchboard, one Ideal engine and complete storage battery equipment from the Electric Storage Battery company. The Gates company has also sold for the United States prison at Yuma, Ariz., a complete electric light outfit, precisely the same as at Phœnix. It has, in addition, installed a 75 horse power multipolar 250 volt motor in the works of Fraser & Chalmers, Chicago, and is placing a 60 kilowatt multipolar dynamo in the Stamford Hotel, Chicago. Four 100 kilowatt railway generators and one 80 kilowatt railway generator are under contract. The Gates dynamo is meeting with marked success.

If any person were disposed to question the standing and importance of the Metropolitan Electric company of Chicago, he need only glance at the second edition of that company's general catalogue, just issued, to dissipate his doubts. The company claims to deal in "everything electrical," and it does not fall far short of making good its claim in the imposing octavo volume of 755 pages which it is now sending out as its catalogue. The book is bound in boards which bear the patriotic colors, red, white and blue, and is sure to be carefully preserved for reference by all recipients. The bulk of the work is the more remarkable when considered in the light of the fact that the company has issued a separate catalogue of 204 pages exclusively for street railway supplies. The present catalogue is devoted to electric light, telephone, telegraph, fire alarm and house goods supplies, and in these lines the intending purchaser can find anything he wants listed, described and probably illustrated. Each article has a trade word and a list number, with the price, so that every aid is given in sending orders "per catalogue." Much valuable information is given in the book, such as diagrams of circuits for bell-hangers, wire tables, electrical units and formulæ, rules for calculating the speed of pulleys, iron pipe sizes, electrical requirements of the Chicago Fire Department, etc. In addition the catalogue is supplied with a telegraph code and carefully prepared indices. The well-known specialties of the company, such as N. I. R. wire, P. & B. compound, Solar incandescent arc lamps, American and ship cored carbons, Metropoliton incandescent lamps, Storey motors, etc., are given due attention. The volume is profusely illustrated and shows careful arrangement. It is one of the largest and most complete catalogues of electrical supplies ever issued, and will be valued by every electrical buyer.

## BUSINESS.

The Farr Telephone & Construction Supply company of 342 Dearborn street, Chicago, finds business good. A number of large eastern orders recently received demonstrate the widespread popularity of the Farr instrument.

The Ithaca Desk company of Ithaca, N. Y., has a fine reputation for its products. Extra grade, medium and low priced desks are supplied, and office men will find the company's complete illustrated catalogue a valuable aid in selecting office equipment.

It is claimed that the Niagara battery, manufactured by the Kester Electric Manufacturing company of Buffalo, will not deteriorate without doing external work. It is said to be the longest lived dry battery made, and it is asserted that its recuperating powers are about double that of any other battery.

The Chemical Paint company, 30½ Second street, San Francisco, has succeeded to the business of A. Grothwell, manufacturer of odorless insulating compounds. The New York agent is J. Ungar, 1745 Madison avenue, who can fill orders promptly. The company will be pleased to forward samples upon request.

The "pony" switches made by the Fiberite company are having a large sale throughout the entire country. Shipments are being made daily by the Mason Electric Equipment company, Chicago, selling agent for the company. The switch is reliable and fully guaranteed. The greatest care is taken to insure perfect contact, while the material used is of the highest grade.

On Monday, December 2d, the Nickel Plate road will sell excursion tickets from Chicago to New York city and return at $18 for the round trip. Tickets good to return for 10 days. Sleeping car berths should be reserved in advance to secure choice of location. Trains leave Chicago at 1:30 P. M. and 9:20 P. M. For further information address J. Y. Calahan, general agent, 111 Adams street, Chicago.

The Electric Appliance company, Chicago, is in receipt

of the following testimonial letter from the Monroe Electric Light & Power company, Monroe, Michigan: "We have one Packard 16 candle power 104 volt lamp still burning every night on an average of over 12 hours a night ever since November 14, 1891. This is the only one left of the lamps of the first lot that we bought of you. It has now burned over 17 500 hours, and it still burns brightly and nicely, and the globe is only blackened up a very little. Can anybody on your books beat that for a long burning lamp? There is no telling how long it will still burn."

W. P. Roberts, president of the Lynchburg, Va., Telephone company, has been in Chicago during the last week. Mr. Roberts has been thoroughly investigating telephone systems. He has just changed his 400 telephone system in Lynchburg by putting in place of the other apparatus a 400 equipment of the Western Telephone Construction company. He contracted while here for a 400 complete telephone exchange equipment of the "Western," which was shipped to Charleston, W. Va., last week. Mr. Roberts says he can earn money with the "Western," although its first cost is greater, and his patrons are satisfied.

The General Electric company has secured the contract for the installation of the new electric lighting plant in both wings of the capitol at Washington. This consists of two engines and dynamos on each side of the building of a total capacity of 6,000 16 candle power lamps. The engines are arranged so that they may be used interchangeably, and in case of accident to one the other may be thrown into service to carry the whole plant. The most important work that this plant will have to perform is in replacing the gas that formerly lighted the Senate ceiling, by either incandescent or arc lights. The heat of the gas above the transparent ceiling of the Senate was something remarkable and at times the temperature above the glass ceiling reached 200 degrees. This not only very sensibly affected the temperature of the Senate chamber, but necessitated the renewal every year of the metal skylight above. The gas burners will be replaced with electric lights. The wire required for the new plant will be furnished and placed by John R. Galloway of Washington.

From H. J. Reynolds, chief engineer of the steamship North Land, of the Northern Steamship company, the Peerless Rubber Manufacturing company, 16 Warren street, New York city, has received the following strong testimonial: "I have used Rainbow packing for steam and hot water pressure of 266 pounds and 500 to 600 pounds respectively, and find it superior to all others. Before using Rainbow packing I tried various other packings, including corrugated copper, and found that they would not hold. I therefore tried Rainbow packing and can cheerfully recommend it as being the only packing for all high pressures in the market to-day."

The Hatch Storage Battery company of Philadelphia makes public a letter to W. W. Gibbs, president of the Electric Storage Battery company, in which the statement is made that the stockholders caused to be made a thorough examination both as to the merits and title of the Hatch battery before becoming identified with the enterprise, and adds: "We were advised by experts of the highest competency that this battery is a complete departure from the type of storage batteries such as are manufactured by your company, and is a distinct step in advance in the art. They also advise us that they are equally as efficient and are lighter and cheaper to construct than other batteries and, therefore, meet public requirement in this line of electrical work. You speak of being informed by your electrical experts and counsel that our battery 'infringes on important patents owned by your company,' and we are likewise informed by our experts and counsel that our patents cover a distinct field and do not in any way infringe on any patents owned or controlled by your company. We are fully prepared to meet that issue in any form or manner in which your company may desire to make it."

Of rubber used for insulating electrical conductors the Bishop Guttapercha company, 420 East Twenty-fifth street, New York, says: "A few years since Mr. Alden, in an address before a rubber dealers' convention in Boston, showed by statistics that there was about four times as much rubber used in this country each year as was imported, about three-fourths of the supply being home production. This was all obtained from old boots, shoes, hose, etc., and is known as reclaimed rubber. It contains all the adulterants used when first made, and is sold at about 10 cents per pound. A little new rubber added and a little slicker make cheap shoes or cheap insulation. The best gum insulation is pure Para rubber, worth at least 90 cents per pound. It is not necessary or practical to use it pure. Four pounds of rubber will make 10 pounds of excellent compound for hose or for wire insulation. It lasts for years on submarine or underground cables. It will stand very considerable variations in temperature and very high voltage of current for a long time; therefore it can be relied on, but it costs, when properly prepared, 40 cents per pound, and you can't expect to buy it on a basis of 20 cents. * * * The Bishop Guttapercha company uses no poorer rubber compound on inside wires than on its river and underground cables. They have never used a pound of reclaimed rubber, and don't intend to."

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued November 19, 1895.*

549,899. Plate for Storage Batteries and Process of Making It. Francis J. Clamer, Philadelphia, Pa. Application filed December 20, 1893.

This is a plate, consisting of a central core of oxide of lead enveloped in a porous metallic jacket of lead and aluminum

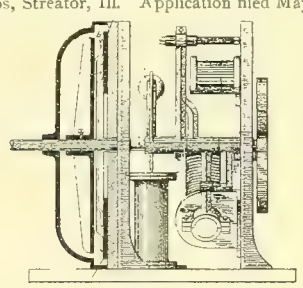
549,906. Automatic Electric Fire Alarm. Harry A. Edgecomb, Mechanic Falls, Me. Application filed January 5, 1894.

A combined push button and automatic electric fire alarm has a suitable non conducting base, with a fusible plug inserted in a recess in the base. plates attached thereto normally out of contact with each other, a spring attached to one of the plates and having its free end held out of engagement with the other plate by the fusible plug, a cover inclosing the base, plates, spring and plug, and a push-button mounted in the cover and adapted to cause a contact between the plates.

549,919. Electrical Indicator. John W. Howell, Newark, N. J. Application filed January 2, 1892.

Two coils are adapted to be connected to a circuit; an indicating hand is mounted on a spindle passing centrally between the coils. There are also a coil or armature on the spindle, a bent magnetic plate on the outer face of each of the two coils for modifying the magnetic field, and a scale having practically equal divisions, over which the hand moves.

549,920. Underground Trolley System. Charlie E. Hubbs, Streator, Ill. Application filed May 23, 1895.



NO. 550,044,

A conduit is described, having transverse ties, a cement bed supported by the ties and having a centrally depressed drain basin connected with a drain pipe, sets of opposite castings cut away at their inner ends above the basin and terminating contiguous to each other to form a slot, track rails seated upon the cement bed near its lateral edges and connecting the outer extremities of the castings in series, road plates resting upon the upper edges of the castings between the vertical planes of the track rails, and a conductor supported by the castings upon one side of the slot and within the space between the cut-away inner ends of the castings.

549,995. Underground Conduit. James F. Cummings, Detroit, Mich. Application filed March 4, 1895.

A conduit having an inner duct, a conductor supported therein free from the sides thereof, a junction box into which the duct leads, and a valve controlling the duct.

550,018. Electrical Steering Gear. Frank L. Dyer and Leonard H. Dyer, Washington, D. C. Application filed October 4, 1894.

One feature of the invention is the employment of a steering engine and an electric motor for controlling the same, a switch at the bow of the vessel for controlling the motor, means for operating the switch, whereby the circuit to the motor will be constantly closed, and means controlled by the main electric motor tending to constantly break the circuit.

550,042. Electric Fan. Philip Diehl, Elizabeth, N. J. Application filed May 11, 1891.

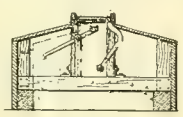
An armature wheel consisting of a central hub is employed, together with a series of metallic blades or wings serving as the spokes of the wheel, and a ring armature outside of and supported by the blades or wings, combined with a field magnet located outside of the armature ring.

550,044. Rheostat for Use in Electric Motor Circuits. Rudolf Eickemeyer, Yonkers, N. Y. Application filed January 14, 1893.

Two connected sets of contact blocks are utilized, in combination with two separate brushes, one in advance of the other, and each in cutting out resistance sweeping over its appropriate portion of the blocks independently of the other.

550,057. Closed Conduit Electric Railway. Herluf A. F. Petersen, Milwaukee, Wis. Application filed October 29, 1894.

This is an underground conduit for electric railway conductors, comprising a casing divided into two longitudinal passages or compartments, one of which is provided in its upper part with a longitudinal slot communicating with the surface of the street or roadway, a slot rail at one side of the slot, arranged to depend into the upper part of the passage or compartment, and provided with a lateral flange, a lateral flange upon the upper edge of the partition between the compartments and a downwardly acting closing device arranged to rest by gravity upon the flanges.



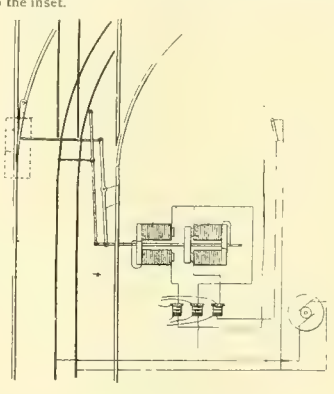
NO. 550,102.

550,059 Trolley. Francis J. Pribyl, Hazleton, Pa. Application filed March 9, 1895.

A device for restoring a trolley wire to the wheel comprises a standard secured to the trolley rod one or more plates or supports sliding vertically in the standard, a shaft journaled in the sliding plates, rollers mounted upon the shaft at either side, and having spiral grooves therein directed inwardly to carry the wire into alignment with the trolley wheel, a cord secured to the shaft and to the standard, and extending around a pulley upon the plate or support, whereby the rotation of the shaft elevates the plate.

550,097. Insulated Pipe Coupling. Edmund E. Clift, Philadelphia, Pa. Application filed September 20, 1894.

In an insulated coupling there is the combination of a casing having an internal shoulder, a pipe within the casing, having an external flange adapted to rest on the shoulder, a cap having a threaded portion adapted to mesh with and be secured to the casing and rest upon the pipe; and insulating material between the pipe and the cap, and between the flange and the shoulder the lower end of the pipe being threaded, a bottom piece threaded, adapted to mesh with the threaded end of the pipe, and provided with a flange, and insulating material between the flange and the casing, the bottom piece having an inset and the lower part of the pipe being enlarged and upset in o the inset.



NO. 550,132.

550,102. Underground Trolley System. Cornelius J. Hamilton, Philadelphia, Pa. Application filed April 26, 1895.

The device shown comprises a cover hinged to suitable supports, and a lever pivoted to the under side of the cover, the lever having curved and straight portions respectively, an end of the straight portion being adapted to project under the end of an adjacent cover, the covers having weights attached thereto.

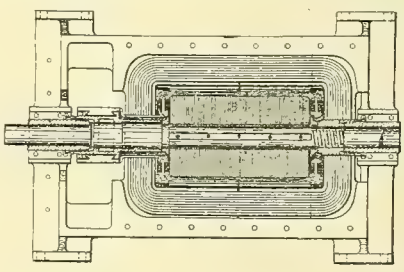
550,132. Electric Appliance for Railways. Herluf A. F. Petersen, Milwaukee, Wis. Application filed March 19, 1894.

Included in this arrangement are an electric railway with an underground conduit and its contained conductors, of suitable contact strips or wires located within the conduit and extending parallel with the conductors, but insulated therefrom, a pair of electro-magnets provided with a movable armature operatively connected by lever mechanism with the movable tongue of a switch in the track, and with movable sections of the conductors within the conduit, contact devices carried by the car and adapted for independent electrical contact with the strips or wires, and a suitable switch upon the car adapted to be adjusted so as to throw a desired one of the electro-magnets into circuit

550,192. Electric Protective Appliance. Alfred H. McCulloch, Boston, Mass. Application filed January 24, 1895.

Three carbon plates or surfaces are separated and insulated from each other, two of the carbons being connected respectively with the sides of a main circuit, and the other being connected to ground; and means are provided for changing or moving the contiguous surfaces of the carbons relatively to each other to dislodge accumulated particles from between the same.

550,204. Toll Collecting Telephone Apparatus. George K. Thompson, Malden, Mass. Application filed August 24, 1893.



NO. 550,220.

There are employed a coin chute, a lever, and means for rotating the lever through an arc proportional to the size of the coin, a contact piece carried by and movable relatively to the lever, several rows of contact points, and a templet adapted to determine the movement of the contact piece over a particular row of contact points corresponding to the travel of the lever.

550,205. Electric Time Signaling Apparatus. James T. A. Todd, Fort Worth, Tex. Application filed February 11, 1895.

An electrical time signaling circuit having an adjustable regulating trailer held in a recessed hour hand by a nut having a milled outer rim and held in a slot in the hour hand, whereby the trailer can be made longer and shorter without being turned in the recessed hour hand.

550,215. Electric Arc Lamp. Edouard Cannevel, Paris, France. Application filed April 20, 1893.

Claim 1 follows: In controlling mechanism for electric arc lamps the combination of a rocking framework carrying clockwork mechanism controlling the motion of a pitch wheel over which passes a pitch chain connected to the upper and lower carbon holders, a tangent escapement with brake disk controlling the motion of the clockwork, and a brake frame acted upon by a spring controlling the motion of the escapement, and electro-magnets on a shunt of the lamp current and carried by the frame and controlling the motion of the frame.

550,220. Electric Car or Locomotive. Rudolf Eickemeyer, Yonkers, N. Y. Application filed April 8, 1891.

Included in the arrangement is an electric motor, having a casing which constitutes central, lateral and longitudinal portions of a motor frame, and four-frame extensions, each detachably coupled to the motor casing, and embodying an axle box jaw, the frame as a whole being adapted to be spring-mounted on two car axles.

Western Electrician.

EVERY SATURDAY.

Vol. XVII CHICAGO, DECEMBER 7, 1895. No. 23

## Electrical Equipment of the Carborundum Works, Niagara Falls.

By Orrin E. Dunlap.

The new carborundum plant at Niagara Falls is a very great success, and this abrasive is now being turned out in larger quantities than ever before. It will be recalled that carborundum was discovered in 1891 by E. G. Acheson, who is at the head of the Niagara Falls company. For a considerable time, before success came to him, Mr. Acheson had been seeking a means of crystallizing carbon, realizing that such a material would prove of considerable value in the field of abrasives, but it was not until 1890, when he became associated with an electric lighting company in Monongahela City, Pa., that opportunity came to try the experiments previously formulated. He then very early availed himself of the new facilities at his command, and in his first experiments he used an iron bowl lined with carbon and filled with a mixture of carbon and clay, into which a carbon rod was introduced. Thus the bowl and carbon rod served as electrodes, by means of which a current sufficient to fuse the mixture was supplied, the object being to cause the carbon to be dissolved in the melted silicate of alumina, and by cooling the same to the point of solidification cause the contained carbon to crystallize. In the experiments, when the current was applied and the mixture heated up, a very violent chemical reaction appeared to take place. Then the mass was allowed to cool, after which it was carefully examined, with the result that several bright blue crystals were found. These were carbide of silicon, or, as they are now called commercially, carborundum. This name is evolved from carbon and corundum, as it was generally supposed, before a chemical analysis was made, that carborundum was a compound of alumina and carbon.

In the plant at Monongahela City, Pa., good results were obtained from the furnaces of 300 pounds capacity, but the market demand was so great that the company, in order to fill the orders, was forced to seek cheap electrical power for a larger plant, which circumstance brought it to Niagara Falls. In the Niagara plant there are five bases or furnaces, each having a capacity from seven to nine times as great as the furnaces in the original Pennsylvania plant. The furnaces, as shown in Figs. 3 and 4, are no more than rough, loose brick boxes, no mortar or cement being used. The interior dimensions of a furnace are about 15 feet long, six feet wide and five feet high. In the center of each end wall of the furnaces is a large bronze plate, to which are connected the cables carrying the current. Connecting with the inner surface of the bronze plates are 60 carbon rods, each of which is about 2½ feet long and three inches in diameter. These rods project through the walls of the furnace and form the terminals.

When the furnace is thus erected it is ready for what is called "the mixture," which consists of coke from the Pennsylvania bituminous coal fields, white sand from Ohio, salt from the saltworks of New York state and sawdust from the mills at Tonawanda, N. Y. These crude materials are first received in the stock room, which is provided with a railway track connecting with the Niagara Junction railway on which the loaded cars are conveyed to the various bins or compartments provided for their reception. Conveniently arranged in relation to these storage bins is a most complete grinding, grading and mixing plant into which the coke as it comes from the cars is introduced and ground and sifted into assorted-sized grains and conveyed into bins, from which it is drawn and mixed in proper proportion, with measured quantities of sand, salt and sawdust, and these measured quantities thoroughly mixed and delivered in a bin provided for the finished mixture. This work is done by automatic machinery at the least expenditure of manual labor.

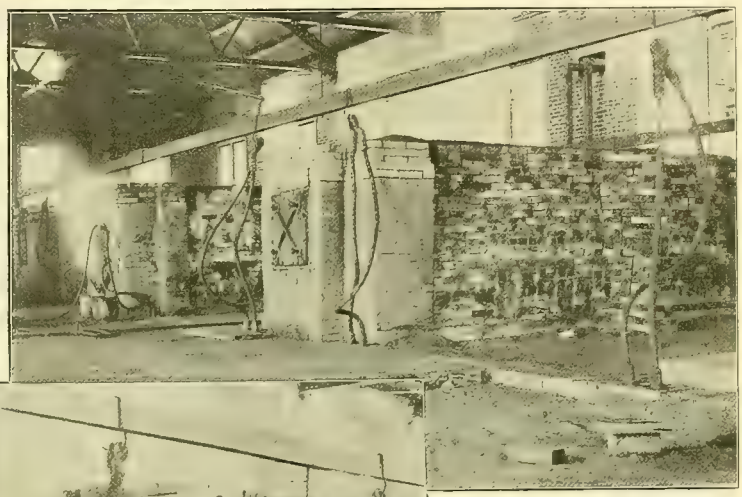


Fig. 2. General View of Furnace Room.

Fig. 1. Furnace Open.

Fig. 3. Furnace in Operation.

ELECTRICAL EQUIPMENT OF THE CARBORUNDUM WORKS, NIAGARA FALLS.

When thus prepared "the mixture" is conveyed to the furnace in an adjoining building, about 10 tons constituting a charge for one furnace. Through the center of this mass is built a core formed of small grains of coke, and this serves to form a continuous electrical connection between the terminals. The furnace, as now described, is prepared for the turning on of the electrical current, and this is provided for and controlled in the adjoining building, which was specially constructed for the transforming apparatus used in reducing the high-pressure current, as received from the dynamos of the power company, to the low-pressure current used in the electric furnaces. Located in the same building is the regulating apparatus, Fig. 5, used in controlling the current as it passes to the furnaces. The transformer and regulator contained in this building are the largest that have ever been built, and the regulator is of exceedingly novel and ingenious construction, absolutely controlling a current of 1,000 horse power. Both the transformer and regulator were built by the General Electric company. The former is the largest in the world, weighing 12 tons and having a capacity of 830 kilowatts. The regulator alters voltage by varying the inductance in the circuit A small pump run by an electric motor keeps oil, which is cooled by a coil of pipe carrying water, constantly circulating through the transformer and regulator.

When the 1,000 horse power electric current is turned on the coke core is soon raised to a high temperature. Fig. 3 shows the furnace in operation. In about an hour after the application of the current carbon monoxide gas is given off freely from the furnace, and when a lighted match is applied this burns with the well-known lambent blue flame and encircles the entire furnace.

The electric current for the plant is applied from the 5,000 horse power generators of the Niagara Falls Power company, and comes to the factory through a cable laid in a subway at a potential of 2,200 volts. In the transformer room at the carborundum factory the potential is reduced to 185 volts. The current then goes to a regulator which serves to "boost" it up to 250 or "choke" it down to 105 volts. When the current is first applied to a furnace it is regulated to the full voltage. After about two hours the resistance of the furnace has become reduced sufficiently low to take a current of about 3,000 amperes at this voltage. When this point is reached the regulation is carried on carefully so that, as the resistance of the furnace decreases, the potential of the current is reduced sufficiently to keep the supply of energy to the furnace at about 746 kilowatts. The dimensions of the core of the furnace are so adjusted that when the current reaches about 7,000 amperes and the regulation can be carried no further, the resistance of the furnace has become constant. This constant state is reached about four hours after the time of starting, and for the rest of the 24 hours, the period the current is kept on, the furnace is supplied with a current of about 7,000 amperes at a potential of 105 volts, a red heat being reached in about 12 hours. After the current has remained on for the period of 24 hours, or until such time as the workman in charge recognizes that it has been properly operated, the current is stopped in the transformer building, the flexible cables are disconnected from the bronze plates and others are connected with the plates of the next furnace in the series of five, and it in turn is carried through the same operation

All interest centers on the moment of opening the furnace, for this action will tell what this immense amount of energy has been doing within the brick walls for so many hours. One end of the furnace is removed and a cross-section through its center exposed, Fig. 1, thus permitting a ready inspection of the results of the operation. In the center is the granular core in the same position in which it was originally placed, but it is now purified of all foreign substances. It is now pure carbon, and has lost about one-fourth of its weight; this loss represents the volatilized impurities. The presence of grains of graphite disseminated throughout its mass indicates that its temperature must have been near 7,000 degrees, which is the point of graphite formation. Surrounding the core, in the form of a cylinder, is a beautiful crystalline formation, the crystals being constructed on lines radiating from the center. Those crystals in immediate contact with the core are looped or built together into one concrete mass, this solid formation giving way to a loose structure as the distance from the core is increased, the size of the crystals at the same time diminishing rapidly until at about 15 inches all crystallization ceases and is followed by an amorphous material of a whitish gray color for a distance of about two inches, when a sudden change occurs to a black mass composed of the original mixture now held together in a cemented state by the fusion of the salt. The crystalline and amorphous material lying between the core and the outer black mass is carbide of silicon, being composed of carbon and silicon, atom to atom. The furnaces at Niagara have developed some wonderfully fine crystals, far surpassing in beauty and size any before seen. Over two tons of carborundum is produced in one furnace run, and to prepare it for the market it is first passed under heavy iron rolls for the purpose of crushing apart and separating the individual crystals, after which it is treated to an acid and water bath to remove solubles. It is then dried and sifted to separate the various sized grains, which are indicated by the number of threads per inch in the sieve through which they pass, and are placed in bins ready for packing for shipment, or to be worked into wheels, hones or other forms in which abrasives are used.

The increased facilities of manufacture at Niagara Falls are such as to practically remove the restrictions which have up to this time surrounded the use of carborundum, owing to the smallness of the amount made, and the development of the trade is destined to be large. For all the Niagara plant has been in operation but a short time, the directors, at their first meeting at the Falls, decided to erect additional buildings there to accommodate two large kilns, each kiln to be about 16 feet interior diameter. When these are completed the Monongahela plant will be closed, and the company's entire business transferred to Niagara.

An excellent idea of the plant and the methods employed may be gained by referring to the accompanying cuts, keeping in mind the explanation already given. In the picture on page 271 Fig. 1 shows the coke core surrounded by carborundum crystals after opening the furnace, and Fig. 2 is a general view of the furnace room. A furnace in operation is shown in Fig. 3, while the view presented in Fig. 4 on this page shows the furnace complete. An excellent view of the transformer room is given in Fig. 5, the attendant being shown in readiness to operate the controller upon which his hand rests. The equipment and the methods employed by the Carborundum company are among the most interesting industrial attractions at Niagara Falls.

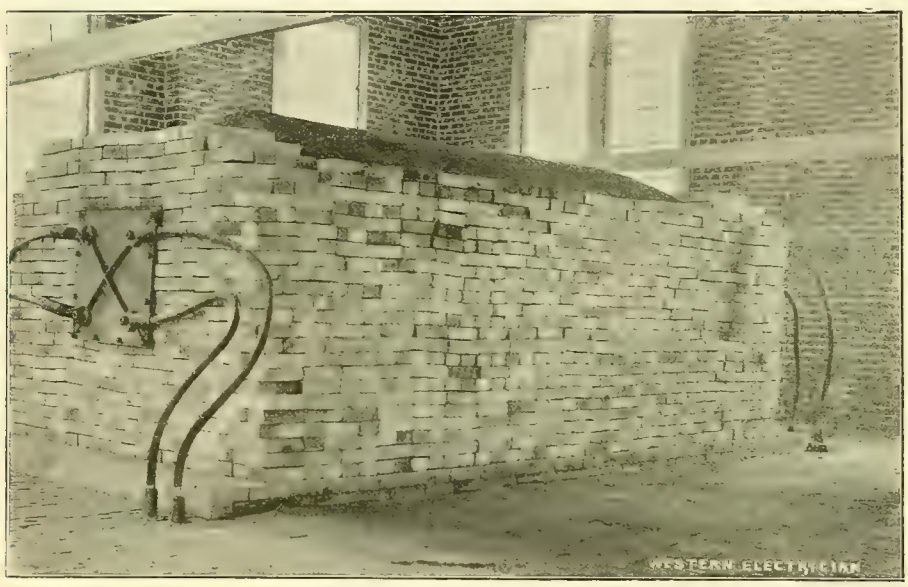



FIG. 4. ELECTRICAL EQUIPMENT OF THE CARBORUNDUM WORKS, NIAGARA FALLS.—GENERAL VIEW OF FURNACE.

## Practical Experience With Storage Batteries in Central Stations.[1]

By C. L. Edgar.

To those interested in selling electricity, it is a source of great satisfaction that the storage battery discussion has within the past few months, especially in America, taken on an entirely new phase. It has become a question of use and not of manufacture.

For years we have all watched with great interest the various types of batteries put upon the market. We have discussed their value, at first confining ourselves as to whether they would work at all, and in later years broadening out the discussion as to how well they would work. We have watched the various companies interested in the manufacture of storage batteries fight one another in the courts, and we have wondered if it were ever to be possible to obtain a battery which did not infringe someone else's patent.

Until very recently it has not been possible to discuss from the standpoint of experience the economic merits of storage batteries, and it is particularly satisfactory to us to note that the discussion seems to have drifted away from the manufacturer to the user. To-night I am going to assume, at least for the purpose of this communication, that these perplexing questions have all been answered, and that we are finally on a par with our neighbors across the water, prepared to discuss the advantages of a commercial storage battery found ready to our hand.

Whatever may be the facts as to the existence of a commercial battery, some of us have purchased and are operating batteries which we consider satisfactory, and I will leave that part of the discussion to others, confining myself exclusively to their uses in an Edison system of circulation and distribution for lighting and power purposes, in thickly settled communities. As it appears to me, their uses can be classed under four great heads, as follows:

First—To carry the peakof the load at maximum hours.
Second—To carry the entire load at minimum hours.
Third—To act as an equalizer or reservoir.
Fourth—For the equipment of annex stations.

There are many other special uses for batteries which can be naturally classed under one of these heads.

*First, To Carry the Peak of the Load.*—In all systems of lighting, whether by gas or by electricity, there is a considerable portion of the connected load which is used only for two hours per day during the three or four months in winter. We have all of us, at various times, very earnestly discussed the probability of being able to widen out this peak, as it is commonly known, and numerous schemes have been devised by which it has been made more or less of a hardship for customers to use their light at this time, special concessions being made at all other hours of the day or night. It does not seem to me that any of these will avail. We cannot get around the fact that there are, in every large city, hundreds of stores which close up at 6 o'clock at night. The only need which they have for light is after it becomes dark. In this section of the country, darkness comes on about 4:30 in midwinter, and these stores are bound to burn their light from 4:30 to 6 o'clock, and have no need of it at any other time. These are facts which are entirely outside of the question of electric lighting, and nothing which we can do will change them.

It matters not whether the company has a large motor load in the daytime or a large city contract at night. These are simply going to change the height of the curve at those hours. They are not going to alter the special shape of the curve due to the hour and a half of darkness during the business day.

This particular peak will be in some cases a much larger percentage of the total maximum output of the station than in others, but I think it is safe to assume that it is likely to vary only between one-third and one-half of the total. In the case of the company with which I am connected, we have found that if we divide our maximum load of the year into two parts, the upper half exists only for about two hours under ordinary circumstances, and four hours under exceptional circumstances for the five winter months.

Computing the kilowatts in these two halves, we find that the lower half contains 90 per cent. of the kilowatt hours manufactured, whereas the upper half contains only about 10 per cent. This would prove the position taken by some engineers that if an extremely large station was to be constructed, it would probably pay to equip it with two types of apparatus—50 per cent. to be of the best economy and most expensive class known to the art. This to do the 90 per cent. of the work. The other 50 per cent. to consist of crude, cheap, uneconomic but reliable apparatus, to do the 10 per cent. of the work. The saving in interest on the lesser investment in the second class would be much greater than the extra cost of running this half, due to its poor economy.

In our particular case we find ourselves in precisely this position. Our company installed in years past about 4,000 horse power of high speed, belted, bipolar apparatus, reliable, but of poor economy. Some three years ago it changed to the other extreme and commenced to equip with the highest priced and most economical apparatus to be found in the market, and to-day there is about 4,000 horse power of this apparatus in use.

The data which we have for 1894 and 1895 proves the statement which I have just made. Ninety per cent. of our kilowatts have been manufactured by the vertical, triple-expansion, multipolar units, and yet the total capacity of this apparatus is not over 50 per cent. of our maximum output for the winter.

The application of the storage battery to these conditions is obvious. What we need, and what all companies under generally like circumstances need, is a piece of apparatus capable of doing two hours' work per day which is cheap, and which has fair economy. If storage batteries could be used under no other circumstances than these, it is, perhaps, somewhat doubtful whether it would pay to install them, but yet I am inclined to think that considering their first cost and the efficiency which we can obtain from them, it could be fairly proved that it would pay to use them rather than what I have designated as the cheap type of apparatus.

At the time our first battery was purchased, our standard unit was 650 horse power. We, therefore, called for a battery of 650 horse power capacity for two hours. We eventually, under stress of circumstances, reduced this to 1½ hours and found that it cost considerably less than a first-class steam plant.

As all apparatus has to be installed for the express purpose of taking care of the maximum load, it seemed to us very clear that if we could save in our first investment by installing storage batteries which cost less than a steam plant, we were going to be able to do a given amount of work with a less amount of capital by this means than by any other. We thus decided to install a battery to take care of the peak, even if we obtained no other advantage from it.

*Second, To Carry the Entire Load at Minimum Hours.*—I think that the nature of the load curve in America is against the use of batteries for this purpose to anything like the same extent as abroad. With us there is only about six hours of minimum load, whereas, owing to the lack of motor business in Europe, the minimum there extends some days from midnight until three o'clock in the afternoon. Our minimum is so short that we are not able to save one shift of men nor are we able to save much in the fixed boiler room expenses from drawing the fires, banking the boilers, or any of the various other expedients used when the plant is not in operation.

Our generating department has gone through some exhaustive experiments, running first the engines for 24 hours a day, charging the battery at minimum load, and then turning around the next week and shutting down the steam plant for the six hours from midnight until six o'clock in the morning, and depending entirely upon the battery. The general conclusion seems to have been arrived at that the former is the cheaper method. Admitting this, the indirect advantages of the former, by which the battery is charged during the night, and can be used during the following day, are very much greater than if the battery were discharged during the night, as it could not be completely charged again until the middle of the afternoon of the following day.

I do not consider our conclusions final, as the local conditions might materially change the result. In our case it happens that the output at night plus the charging current of the battery is just equivalent to one of our standard units. If it were necessary to run two units to do this work, our conclusions might have been different, so that I think this is a case which has to be decided in each place on its own merits.

*Third, To Act as an Equalizer or a Reservoir.*—It is this use of the battery with which we have been particularly pleased, and in order to understand it it is perhaps desirable to explain the needs which a modern station has for apparatus of this kind. Years ago a distribution company was equipped with one station, furnishing electricity through a system of feeders supplied from one bus-bar. All this is changed. To-day the modern station manufactures electricity in various places, transfers it from one station to the other at will, sends it out through a system of distribution at three or four pressures supplied from bus-bars of varying potential. At the minimum hours of the day the electricity is manufactured by one set of dynamos, part of it being delivered to the bus-bar in the station in which the dynamos are located, the remainder being sent out over tie lines to various annex stations and delivered there to the local bus-bar. The amount of current is so small compared with the capacity of the various circuits that practically the pressure delivered at the lamps is constant notwithstanding the various roundabout ways in which it reaches them.

As the load begins to increase the drop over the tie lines becomes noticeable, and it is necessary, by means of auxiliary dynamos known as boosters, to raise the potential of that part of the output which is delivered to the tie lines.

1. Communication presented at the meeting of the American Institute of Electrical Engineers, November 20, 1895.

The load still increasing it is necessary to start additional dynamos. These may be thrown in multiple directly with the original pair and deliver the same potential as the others, or, if the condition of the road warrants it, they may be thrown in multiple with the original dynamos and the booster in series and deliver the potential needed by the tie line. In this case the booster might be taken out of circuit.

The load on the tie line again increasing, the booster would be again put in use, and we would thus have the condition of a tie line supplied partly by a dynamo of the proper potential and partly by additional current furnished by a booster, raising the potential from another bus-bar supplying current locally.

This goes on until nearly the maximum load is reached. It then may be found, as it is sometimes in our case, that the original or main station is not equipped with sufficient dynamos to supply the local distribution. In this case the current over the tie line is reversed, and the annex station sends current to the original station, which arrives there at somewhat lower potential than is needed, and is there raised by means of a booster to the bus-bar of that station. It is necessary to understand that these are every-day occurrences, and if we were not equipped with a battery, it would be almost an hourly question as to what it was necessary to do next, whether to start dynamos, stop them, change boosters or any other of the innumerable combinations which might be made. This trouble is intensified by the uncertainty as to what changes are going to take place in the output, and what the load is going to be at any given time. In a very large degree the battery answers all these questions or at least makes them unimportant. It makes it possible to determine beforehand what the regular day's work of the steam plant is to be, to decide how many and at what time boilers are to be put in service, when engines are to be started and stopped, and in general to operate the plant to its best economy, knowing that daily or hourly in-

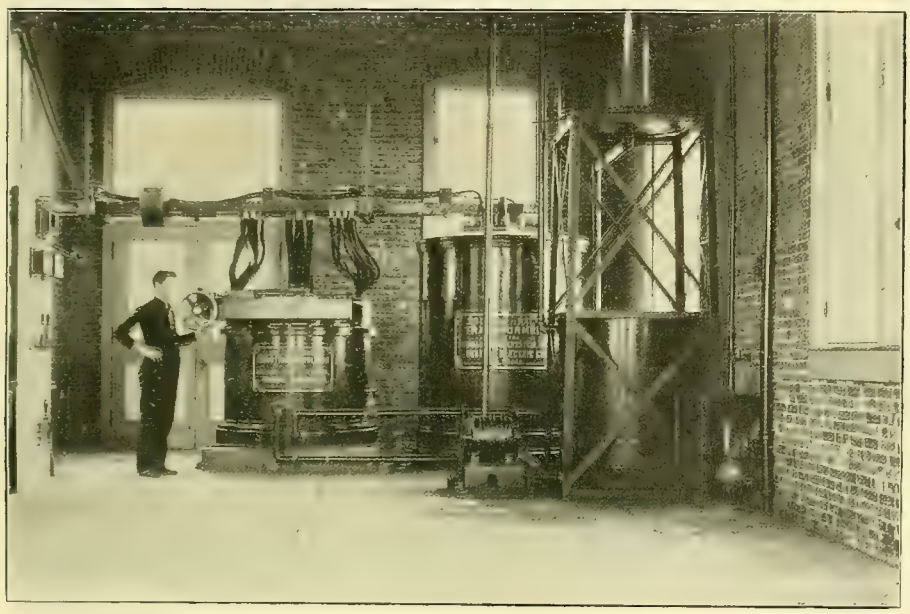


FIG. 5. ELECTRICAL EQUIPMENT OF THE CARBORUNDUM WORKS, NIAGARA FALLS.—TRANSFORMER ROOM.

equalities in the load, or uncertainties caused by the weather, will be taken care of by the battery.

It is kept in multiple with one or the other or all buses at all times. It is supposed, for many hours of the day, to be standing idle with the ampere meter at zero, but it may, without a moment's warning, be called upon to either give or take anywhere from one to 3,000 amperes on a side. It is possible in this way theoretically to keep every engine which is running loaded up to its maximum economy at all times. Practically we have found it possible to never operate an engine with less than three-quarters load. The economy of the steam plant then more nearly approximates what is known as mill practice, which is the goal toward which we are all striving.

Having satisfied ourselves in the beginning that with a given amount of capital we could do more work with the battery than without it, we by actual practice came to the conclusion that we could by the same means do this same amount of work more cheaply. When we remember that we installed the battery for the express purpose of taking care of the maximum load, we are, of course, particularly pleased at the very great use we can make of it for this purpose of equalization, and yet, in addition to this, we have made enough tests to prove to our own satisfaction that we do not lose anything in fuel economy by this particular use of the battery. The watts lost by the inefficiency of the battery are made up more than fourfold by the better economy of the steam plant. We have taken typical winter days and figured out exactly the cost of running our system with the battery and without, and have proved that the actual coal consumed with the battery is a material amount less than without it. If, in addition to the fuel, we take into account the very great saving in the labor, the added reliability and the better service given, we will see that these uses of the battery are even greater than those for which it was originally installed.

I do not think it is possible to over-estimate the advantages of storage batteries for the purpose of giving regularity and reliability to a system of distribution. With very sudden fluctuations in the load which are continually taking place, it is almost impossible with dynamos alone to regulate the bus pressure so quickly that the pressure throughout the system remains constant. Of course, we have done this for years to the best of our ability, but it has necessitated keeping everything in first-class shape and having the employes of the company on the alert at all times to take care of this question. The uses of the battery very much simplify this problem. Very many times where in the past it was necessary to change the magnetism of the fields of dynamos it is now necessary to do absolutely nothing, the battery acting as a reservoir, giving out quantities of current without any apparent change in pressure for the time being.

This question of regularity is very closely connected with the one of reliability. To those of us who are identified with central station work there is a great sense of security when we realize that whatever may happen to the steam plant, we have sufficient battery to carry us over a few minutes of disorder. In our particular case, we have at the present time sufficient battery to run 60,000 lamps for five, 10 or 15 minutes, depending upon how great is the emergency. This advantage of the battery may not appeal to an outsider. I do not think they can realize the intense nervous strain to which all connected with the successful detail operation of the station are subjected. If a battery and a steam plant were on a par in all other respects than this, I should personally feel very much inclined to install it for this reason alone.

*Fourth, For the Equipment of Annex Stations.*—This is a use to which we have looked forward with great interest, but up to the present time have had no occasion to make the use. There are in every city certain sections, located so far from the centers of distribution that it becomes a very serious and expensive matter to reach them with the regular three-wire system.

When we realize that it makes very little difference to which end of a tie line a storage battery is connected, we can see at once the special advantage which this type of apparatus gives us. If of such value that it will pay to install them, it is a matter more or less immaterial whether they are installed at the main station or at an annex station connected to the main station by tie lines.

The fixed charges of running a battery room are very small as compared with those of a steam station, and there would not be any very material increase of fixed expense between one large battery located in a central point and a half a dozen small ones distributed throughout the city.

Storage batteries, therefore, lend themselves particularly to the location of a "central" station at some convenient point upon the water front, and the building up of small centers of distribution scattered throughout the city, consisting of storage batteries with or without a steam adjunct and connected together possibly, but certainly each one connected to the central station.

This communication may be considered to have been written upon very narrow lines, and I may say that this was intentional. So much has been written during the last few months upon generalities and upon possible cases which may or may not exist, that it is sometimes valuable to brush these all one side and to confine oneself to some specific case. This I have tried to do.

Our company has used the first battery 20 months, and one of double its capacity for six months, entirely too short a time to come to any conclusions about the depreciation, but it has given us ample time to satisfy onrselves as to the economic value. It is sufficient for me to say that if a need should arise to-morrow for additional capacity, either at our main station, at either of the annexes, or in any new part of the city, within reasonable distance of our center of distribution, we should consider the question along the lines which I have just indicated. We should eliminate entirely from the discussion the question which has distracted the public mind for so many years and decide it entirely upon its merits, placing the battery side by side, and on an equality with other modern and improved apparatus.

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John H. Culver of Decatur, Ill., was granted a franchise by the city council of that place for putting in an electric light plant to cost $10,000. The franchise is for 20 years and the contract with the city will be for 10 years

## Past and Present Obstacles in the Storage Battery Development.[1]

By Carl Hering.

The great and numerous advantages of a satisfactory electric storage battery have been described so often and are so well recognized and admitted by the unbiased that it seems unnecessary to again enumerate and discuss them here. The question which the engineer and constructor should discuss at present is not "Is a battery desirable?" but rather "Why is it that storage batteries seem to have been unsatisfactory?" and the question which concerns the capitalists is "Does it pay in dollars and cents to use the storage battery even if it is kept in a satisfactory condition by the makers?"

The latter question can be disposed of here in a few words. If the makers guarantee to keep the battery in a satisfactory condition for a certain rate per annum, or if they rent them, then it becomes a mere matter of calculation to find whether it pays or not; but this calculation must be made for each specific case, as the cost of the batteries and their maintenance seem at present to be such that an estimate for a general case can hardly be considered conclusive, the margin being in many cases too small. In some specific cases it will be found to be decidedly cheaper; in some it will be doubtful, and in some decidedly too expensive. Limiting ourselves to this country and judging in a general way from the number of storage battery installations, it would seem that the price at present (including, of course, the cost of maintenance) is such that in perhaps a majority of cases the margin of profit to the user is so small or so doubtful that it does not balance the supposed risk. The commendable practice of renting relieves the purchaser of this risk, which then leaves the question a mere matter of cost. A material reduction in the first cost and cost of maintenance would therefore at once turn the tables in many cases so decidedly in favor of the storage battery that there would be little doubt left as to the economy, and it would render the practice of renting unnecessary in most cases. Cheapness, therefore, is one of the most important points which affect the outlook of the storage battery.

To return to the first question, "Why is it that storage batteries seem to have been unsatisfactory," we must limit ourselves to this country, as probably thousands of tons are and have been in successful use abroad. In Germany, for instance, almost every one of the large continuous current central stations is equipped with a battery plant; in England they are used very largely for private plants, as also for central stations; an English firm recently claimed to have sold a total of "six miles" of accumulators placed in one continuous row, and a French firm is stated to make several tons a day.

The chief reason why so few storage battery plants exist in this country seems to have been that the accumulator companies have for years been so busy fighting one another's patents and have spent so much money in this litigation that they have had neither time for money left to manufacture and install their batteries. But all this litigation has now come to an end, thanks to an enterprising company which has bought up all the little life that is left of these historic "pasted plate" patents. This, together with the fact that it is now conceded by many authorities that for many if not most purposes the unpatented Planté type of cell is the better, removes the chief obstacle in the storage battery development in this country. The fact that the companies have been too busy with litigation to attend to legitimate business has shaken the confidence of the public, who naturally ask, "Where are your batteries in use?" the only and unsatisfactory answer to which is, "Abroad." Much "missionary work" must first be done before public confidence will be restored, and let us hope that the recently started "rental" companies will soon accomplish this. It is up-hill work, but prospects at present seem bright and encouraging.

As the patent question has now been settled, and as cells of the Planté type have now been developed into practical forms, the storage battery outlook at present lies largely in the hands of the constructing engineer, and we should therefore look at the question from this standpoint.

The storage battery has for years had the reputation of being like a delicate, sickly baby, continually threatened with half a dozen diseases, and requiring the constant attendance of a trained nurse, beside the fatherly care and large purse of its manufacturer. To the user the five chief diseases of the accumulators appear to be buckling, short-circuiting, sulphating, disintegration and dropping out of the peroxide. Many inventors have thought that most of these may be made uninjurious by a process of opposing or resisting their disastrous effects, as distinguished from preventing their occurrence, although the term "preventing" has incorrectly been used to describe it. Buckling has been opposed by main strength and sometimes awkwardness, short-circuiting by porous insulating sheets between the plates, falling out by enclosing or locking the peroxide so that it cannot drop out, etc. Whether and how far such heroic methods have been successful can be determined only by tests, but it seems to the writer that many of the methods are like curing corns by cutting off one's feet; the cures may be effective, but can hardly be called satisfactory. To attempt to prevent the almost irresistible force of expansion of the peroxide from exercising itself, by confining the material in an inelastic lead frame, is a formidable and it seems an almost hopeless task; the inevitable result is that one or the other must give way; if it is the peroxide, it will ultimately be crumbled by the pressure; if it is the lead, there will probably be buckling or at least a separating of the contact surfaces at the subsequent contraction of the peroxide, and this inevitably results in the formation of that very objectionable layer of white sulphate which practically insulates the active material from its conductor, the consequences of which are sure to be fatal. The development of the storage battery has been greatly retarded by the fact that it was in the hands of mechanical engineers instead of chemists.

The careful constructor should attack the problem in a different way; he should go back to the beginning to find out the prime causes, and then prevent, if possible, these causes from arising, rather than to attempt to oppose their

1. Communication presented at the meeting of the American Institute of Electrical Engineers, November 20, 1895

effect by sheer force and awkwardness. These causes seem now to be understood, and the question therefore is how to prevent them. One way is to supply with each battery a printed and neatly framed long list of "don'ts" or limitations in the form of rules telling you what you must not do, with a foot note attached saying that the company's guarantee ceases if these rules are violated. This may be satisfactory to the company but certainly not to the user. A more satisfactory way would be to construct the plates, if possible, so that these prime causes of trouble cannot arise, no matter what mistakes the attendant may make or what emergencies the battery may be called upon to meet, within reasonable limits, of course. To discuss all these prime causes in detail would require writing a treatise on the subject, but they may be summarized briefly, and their prevention will then suggest itself.

The chief evil effects are apparently caused by too rapid charging and discharging. With many of the favorite methods of avoiding the effects of high rates, the capacity and efficiency at such rates both become so low that the user will be discouraged from discharging so fast, and the current will fall so rapidly that it will have little chance to do much mischief. Such methods are applicable only when rapid rates are never desired, but those cases are the exception, rapid rates, or at least a provision for them, being generally very desirable and often essential, as in traction work, for instance; such methods have therefore solved this problem only for a limited field. What should be done is to try to construct the plates so that they are adapted to high rates without a great loss of efficiency or capacity

It will be found that in the majority of cases in which the storage battery would be of special value, it is a question of rate rather than capacity; that is a great horse power for a short time is more often required than a large quantity of energy delivered at a slow rate. It seems from a number of cases, about which the writer has recently been consulted, that any capacity above that which is obtained at a one, two or three hour discharge is generally of comparatively little value.

To study the effects of rapid discharges it must be remembered that the acid is as important as the lead oxides; when its density falls too low there will be a lowering of the electromotive force; acid is withdrawn from the solution during discharge, hence the diluted acid in the fine pores of the active material must get out and denser acid must get in; but the only force which does this is the difference between their specific gravities, and as this is very small, the force will be small, and therefore the circulation will be slow, which in turn reduces the electromotive force. The chemical action will therefore be confined chiefly to the external surface, which is freely exposed to the acid, and the action then becomes so great per unit of surface that white sulphating, or better, complete sulphating, takes place. If a rapid discharge is not to injure the plates or lower the voltage by reason of the acid in the pores becoming too dilute, the circulation must be rapid; great porosity accomplishes this partly, but is attended by frailty and poor conductivity of the peroxide, which again results in a fall of the voltage. The ideal method would, therefore, seem to be a vertical lead plate to act as a good conductor with an extremely large surface and a very thin layer of peroxide on it, freely exposed to a large quantity of acid, which is capable of circulating rapidly. That such a plate may be made to have a greater capacity per pound of plate for rapid discharges and perhaps an equal one for slow discharges, as compared with the best thick, porous plates, has been shown by experiments. The great capacity is doubtless due to the fact that the active material is more completely utilized, as it is all close to the conductor and freely exposed to the acid. The capacity of such a plate will evidently be affected only slightly by the rate and the loss of voltage, and therefore the watt efficiency will depend more on the conductivity of the lead than on the acid becoming too dilute in the immediate neighborhood of the active material. To obtain high rates accompanied by good efficiency and capacity, there is little doubt that the best way is to use large freely exposed surfaces, rather than to try to resist the evil effects of high rates, mechanically.

In rapid charging the acid becomes too dense in the pores of a thick mass of active material if the circulation does not keep pace with the demand; this dense acid softens the peroxide and there is a tendency to form gases, when the proper chemical action cannot keep pace with the current. Both the softening of the peroxide and the mechanical effects of the gases are injurious. What was said regarding porosity and the ideal plate applies therefore also to the charging.

The negative plates, being soft and tough, are not so easily injured, but unless the acid can circulate very freely there will still be a lowering of the voltage like with the positive plates, and probably also a lowering of the ampere-hour capacity.

The contact between the peroxide and its conductor must be very good, for, if poor, then a white sulphate forms at the surface, which practically produces an insulating layer, and disastrous effects are then inevitable. The ideal contact is obtained when the peroxide is formed on the lead electrolytically, as in the Planté processes.

The peroxide will insist on expanding during the discharge and on contracting during the charge. It would be much better to accept this as an inevitable fact than to try to keep the material from obeying the laws of nature by forcibly confining it within an inelastic frame, as many inventors have attempted to do; the results of such an attempt have already been described. To hold a large mass of active material firmly in contact with a lead conductor, when one expands and contracts while the other does not, or expands without afterward contracting again—is a difficult matter. The best solution seems to be, to have the active material in the form of an extremely thin layer over a large surface and formed from the lead itself, as this increases its adhering properties. If such a layer can be made porous and if the surface is made up of small facets, there will be little tendency to buckling or scaling.

The gradual washing away of the surface of the peroxide, and the slow peroxidation and consequent disintegration of the lead support, seem to be absolutely unavoidable. Until some preventive is found, if it ever will be, it seems wisest to accept the inevitable and acknowledge that the positive plates are perishable. To use any other metals or carbon is out of the question; the addition of antimony to the lead seems to retard but does not prevent peroxidation. The favorite method of trying to avoid the effects of disintegration is to make the frames of the positive plates quite thick, thus prolonging their life. This, if not accompanied by other disadvantages, may be satisfactory for stationary plants in which the great additional weight is no hindrance, the only objection to it being the cost of the metal, which is no small factor in the total cost of the plate. But such a method is certainly not satisfactory for cheap or portable cells, and the gradual washing away of the peroxide remains the same whether the frame is heavy or light, provided that the surface exposed to the liquid is the same.

But there is another way of meeting those unavoidable effects of use, which has recently been applied, and which seems to be a much more rational and effective solution of this vexed problem, at least when lightness and smaller first cost are desired. Instead of making the positive plates heavy and expensive, they may be made very light, cheap and easily replacable; their life may then be shorter, but the battery will be as good as new whenever these perishable parts have been renewed; their life is soon known to the user, and he can then readily determine for himself how much he must allow for amortization. Anyone who has urged the use of accumulators will appreciate the great value of being able to satisfy the user as to the amortization factor. A purchaser will believe you if you admit that the life of the perishable parts will be comparatively short, but he will not believe you if you say it will be long, even if you are telling the truth. But such a method, to be successful, requires that the old plates and sludge can be converted at a small cost into new plates; this, it seems, can now be done, and the writer believes that this alone will have a very important bearing on the outlook of the storage battery, at least for portable cells, as are required for traction and many other purposes, or for both portable and stationary plants, if the first cost is an important factor. Such a method becomes practicable only when the chief factor in the cost of the plate is the material, the cost of labor and forming being small.

For stationary purposes, in which the only objection to the weight is the first cause of the lead, good storage batteries have been used abroad with success for some time, provided the rates of charge and discharge are kept low. Assuming that the same storage batteries may be made in this country as well, the question which affects the outlook here is then only one of the cost. But neither abroad nor here does there seem to be a battery in the market in which the weight has been sufficiently reduced and the rate sufficiently increased for a really successful traction battery the success of which has been demonstrated beyond dispute. It is here assumed that to the public and to railway companies traction batteries are not a demonstrated success until a traction company which has no affiliation with the accumulator makers finds it to its own advantage to use them in preference to other systems. That accumulator traction is the ideal system has been repeatedly acknowledged by good authorities, and that this field for batteries is very large and perhaps larger than that for stationary work is likely. The large first cost and cost of maintenance of the overhead construction for trolley roads, the large power station required and the threatened damages done by electrolysis would doubtless turn the tables in favor of the storage battery for many long roads on which traffic is not too dense, and possibly also for many suburban steam roads.

It seems to the writer that the only batteries which have a promising outlook for this very trying work are those which have a very large surface, very small depth of active material formed electrolytically, and a very free circulation of the acid. The lead frames should be made only thick enough for proper conduction, the batteries must be cheap in first cost, and the positive plates should be capable of being replaced comparatively frequently at small cost. They should be proportioned so that a discharge corresponds to one trip of the car—and only one. To claim as an advantage that a battery can run a car, say, four trips is mere deception, and to the intelligent engineer it is simply an admission that it can do no better. No one would think of carrying four relays of horses on a trailer of a horse car, and why should the equivalent be done with the storage battery unless it is that the battery can do no better and that it cannot be discharged rapidly enough so that the capacity and weight may be reduced to that required to run only one trip. The ideal is certainly a single trip discharge. If the rate for a four-trip battery could be increased four times without materially affecting the capacity, its weight and capacity for a single trip discharge would evidently need be only one-fourth as great. The charging rate should also be equal in hours to the discharge rate, or else it will take a plant of more than two sets of batteries to a car.

These various ideals mentioned above would have only a theoretical and not a practical interest, were it not for the fact that recent tests have shown that a near approach to them has apparently been reached; it is somewhat premature at present to say more until the results of the tests have been confirmed by practice.

The above discussion may be briefly summarized as follows: Cessation of litigation and the development of the Planté type of cells make the storage battery outlook in this country much brighter. The cost of a guaranteed storage battery seems in many cases to be too nearly equal to that of the direct generators to encourage their general adoption. A reduction in the cost would therefore open a large field, much larger than in proportion to the reduction. The renting of accummulators seems a commendable method for introducing them. Most of the diseases which storage batteries are subject to could be avoided or made much less disastrous by having large surfaces, small depths of active material and free circulation. The first cost would be reduced and the vexing question of the uncertain amortization, settled, by a light, short-lived, cheap positive plate and a cheap process of re-converting old into new positive plates. Storage batteries for slow discharges have been a success abroad; a very large additional field would be opened by a light, cheap, rapid-rate cell.

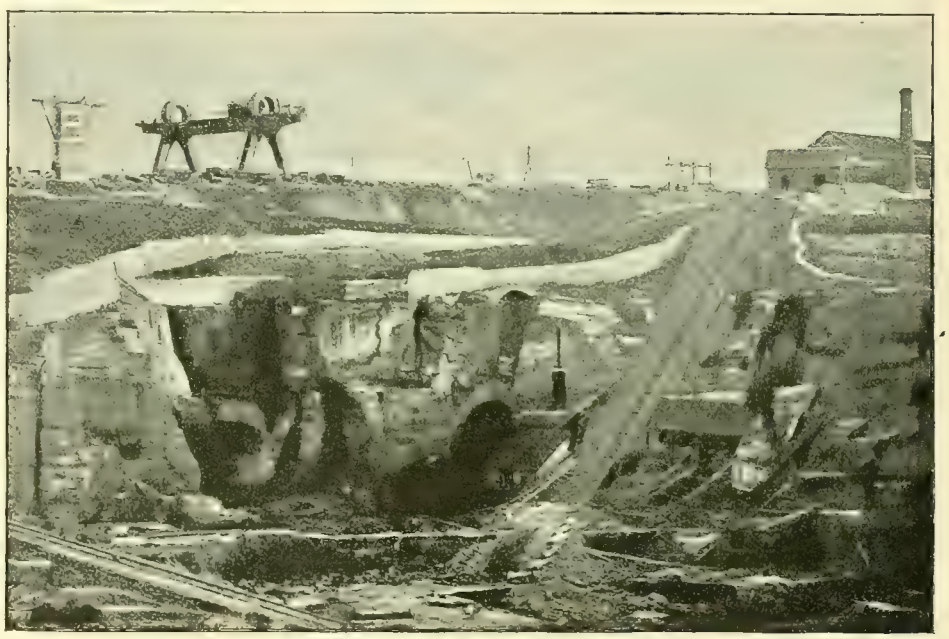

FIG. 1. ELECTRICITY IN STONE QUARRIES.—VIEW OF THE QUARRIES OF THE HAINAUT COMPANY.

The objection to a plate with a thin layer of active material is that it may not retain its charge as well as one with a thick layer or pellets, but in most cases in which rapid rates are desired or cannot be avoided, the small loss in standing is probably more than balanced by the fact that the plates are not injured by rapid rates. As a rule, long periods between charges go hand in hand with slow discharges and less objection to great weight, while short periods between charges, high rates of discharges and lightness usually go together.

In conclusion the writer desires to take this opportunity to make the following recommendations in the interest of engineers who may have to calculate accumulator plants:

That rates of charge and discharge be designated in hours and fractions, the current (or for power purposes, the watts) during that time being considered to be kept constant. There can then be no mistake as to what is meant, as this represents the time in hours during which a cell will continue to give a practically constant current before the voltage falls below its limit.

That efficiences and capacities be always accompanied by the corresponding rate in hours.

That in giving an efficiency it should always be stated whether it is for ampere-hours or for watt-hours.

That for portable batteries intended for power purposes, the capacity be given in watt-hours instead of ampere hours and that the weight given be that of the complete cell ready for use, as distinguished from the weight of the plates alone.

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The village of Sauk Rapids, Minn., will vote November 19th on $25,000 bonds to secure the establishment of a $250,000 paper mill there by John Strange of Menasha, Wis., who agrees for the bonus to put in an electric light plant, operate it for five years and then turn it over to the village without further charge.

## Electricity in Stone Quarries.

Throughout much of Europe there is a rapid increase just now in the application of electrical machinery to many and varied industries, in which formerly steam power only was used. Comparison of data showing the relative efficiency and economy of these syetems has been made by a French writer, and his figures and deductions are interesting. One of the applications to which electricity is being successfully put is that of operating stone quarries. Concerning the steam plant this writer says: Suppose we have a boiler evaporating 8.5 kilograms per kilogram of coal. A good machine of 300 horse power requires not more than 6.5 kilograms of steam per horse power indicated. This will give an indicated horse power for every 765 grams. The transformation of mechanical into electrical energy means 6 per cent. loss; add to this 7 per cent. lost in conductors, and an absorption in the receiver of 12 per cent., and there is a total loss of 23 per cent. Suppose we have a stone saw motor of 20 horse power. The central machine will develop, say, 30 effective horse power or about 33 indicated horse power. The consumption of coal then will show a total of 610 kilograms per 24 hours.

In the old method it was necessary to provide steam apparatus, boiler, engine, etc., at several points in the plant, where all were necessarily in the open air, where condensation was responsible for much loss of valuable power, and where an engineer and often an additional helper were required for each. Cheap and possibly inefficient employes were procured; as a result the machinery was constantly subjected to improper treatment through unskilled labor, and, worst of all, the great item was the enormous consumption of coal in comparison with the amount of work done, because of the intermittent character of the services required.

On the other hand, electrical apparatus can be run by one good steam plant, properly set, well housed and handled by a few first-class engineers and helpers. This forms one class of economies which are of themselves of great value to the owner. Again, the principal generator only absorbs an amount of energy proportioned to the work, and when an hour of rest or idleness occurs for a portion of the quarry less cost is chargeable to the operating account.

In the old method the engines were often located of necessity at almost inaccessible points in the quarry, and fuel was often delivered at the mouth of the furnace by hand. Frequent repairs were required because of the necessarily imperfect installation of these temporary plants, and the consumption of oil and grease, where these were of so many different qualities and handled by cheap employes, formed a by no means trifling entry on the credit side of the cash account. Fewer employes, and consequently a smaller percentage of accidents, favors the electric side of the discussion. Again, the amperemeter gives the electrician a sure test of the amount of work, which can never be excessive, and breakage, which with steam motors could not be anticipated, can be prevented when a dangerous limit is being approached.

The speed of electrical machinery is so readily controlled, so gradually increased or lowered at will, that its advantages over steam, which produces sudden and irregular action, are apparent to all. Yet at will the power can be enormously raised, so flexible is the electric system. Simple mechanism is employed, and not the least danger of an explosion or failure exists.

The electrical system has an additional and very important advantage over steam when the winter sets in. Then frozen pipes, extra pay for employes whose duty is to thaw the apparatus and get it in working order by bell time, and who remain after hours to properly care for the cold of the coming night, or possibly night men, whose duty it is to watch and ward off the frost by keeping the machines hot, and thus waste fuel during half the 24 hours—all these add materially to the expense account.

The electric plant, with its engine and dynamo properly housed and cared for, requires fewer employes, less watching, and wastes less fuel on account of the rigors of winter. It sends its power through a conductor which, if anything, rather rejoices in the weather which sends a deathlike chill to the veins and arteries of the steam and water systems. The pumps may be run at night by the central station man, and during the day are easily watched by an occasional visit of an employe. Sunday service is similar to night service.

A quarry having two tracks for raising the huge blocks from their beds needs but a single good employe for the two when these are handled electrically, and, further, if this control be in the repair shop, much of his time might be employed in putting implements and tools in order. The motors which drive the saws are handled by the quarrymen themselves, who are not required to know more of electricity than a motorman on a street car.

Considerations similar to those recited impelled the Hainaut Quarries company at Soignies, Belgium, to adopt the electrical and discard the superannuated system of handling their enterprise two years ago. At that time an article on the plant was printedin the WESTERN ELECTRICIAN. The quarries of this corporation cover a space of 41 hectares—about 96 acres—and yield a famed quality of stone for building purposes. A single Sulzer compound engine of 300 horse power was installed, which, in addition to moving the stone saws, furnished power to run two generators for mixed service; lighting the premises and actuating pumps, capstans, cranes, traveling bridges, etc.

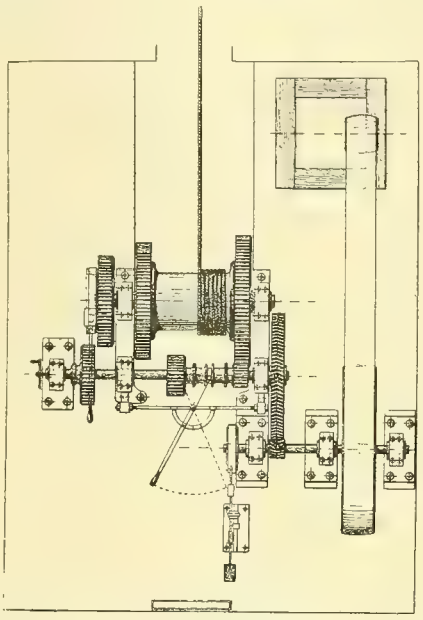

FIG. 3. ELECTRICITY IN STONE QUARRIES.—WINDLASS WITH THREE SPEED GEARS IN THE QUARRIES OF THE HAINAUT COMPANY.

The buildings of the company cover 100 meters, embracing 35 machines running day and night, dressing the rough product of the quarries, which sometimes reach an altitude of four meters, where over 350 cubic meters of stone are constantly under the saws.

For the handling of these immense blocks a traveling crane of 60 tons capacity is actuated by an electric motor, Fig. 2.

The first installation, finished in March, 1893, comprised a Lahmeyer four-pole compound-wound generator, developing, at 525 revolutions, 420 amperes at 120 volts. Tests made at the factory showed an efficiency of 92 per cent. Two motors were installed simultaneously with the dynamo for a windlass and a pump. These are arranged to transmit power by pulley to a shaft for actuating other machinery in case of accident.

The pump motor has four poles and has a speed of 650 turns, and is of 14 horse power, with an efficiency of 87 per cent. The pump makes 24 revolutions per minute.

The second motor is fixed upon a frame above the quarry and is used for lifting the heavy blocks after the workmen have broken them loose. With a movement of 630 revolutions, consuming 180 amperes at 110 volts and an efficiency of 83 per cent., this motor actuatesa shaft running at 300 revolutions, which is farther slowed down to a second axle of 100 turns, which has an endless screw cog transmission adjusted for two speeds, as shown in Fig. 3. A rope of hemp with six armor strands of steel and about five centimeters diameter runs direct from the drum to the chain attached to the stone block. The smaller blocks are drawn on the ground direct, but the larger, sometimes of 60 tons weight, are moved on rollers, the stone moving at a rate of two meters per minute.

Owing to the irregularity, as well as to the range of the power required, an automatic cut-out is attached, but the skill of the workmen is equal to the task, and their care and watchfulness render blow-outs of rare occurrence.

After an experience of several months an addition to the original plant was made in 1894, consisting of a generator of 100 kilowatts capacity, furnishing 800 amperes at 125 volts, with 470 revolutions, for three additional motors.

Two switchboards were arranged so that changes could be made by which the entire load of light and power (up to their capacity) could be thrown on either generator.

One motor of 300 amperes has an efficiency of 88 per cent. and is placed 75 meters from the generator, and handles through belt transmission a traveler having three rates of speed. These reductions are not made through a screw, but direct by cogwheel changes (Fig. 3).

The incline is 105 meters in length with a grade of 34 centimeters per meter. At different rates of speed the loads are drawn out as follows: twelve tons in five minutes; 25 tons in eight minutes; 60 tons in 18 minutes. Proper appliances are arranged for instantly stopping the machine in case of an accident to the electrical portion.

A second motor is at the bottom of the quarry for drawing the blocks away from their beds. It is bipolar, runs at a speed of 800 revolutions, absorbing 200 amperes at 120 volts, and has an efficiency of 88 per cent. It is belted direct to an endless screw.

The third motor of this installation (30 amperes, 120 volts moves a traveling crane of 10 tons capacity, in the cut stone department, at 150 meters away from the dynamo. It makes 1,000 turns and is belted direct. All these machines are shunt wound and have reversing rheostats. The mean efficiency of the installation is 75 per cent.

FIG. 2. ELECTRICITY IN STONE QUARRIES.—SIXTY-TON TRAVELING CRANE OF THE HAINAUT COMPANY.

## Good Work Under Great Difficulties.

Telegraph men everywhere will be interested in the following statement made by an officer of the Postal Telegraph-cable company at Chicago. It will also be of interest to the general public, showing, as it does, the remarkable facilities of communication at hand to-day: "On November 27th," the gentleman said, "when our facilities were much impaired because of the havoc made by the severe sleet storm of November 25th, Operator 'Bolassa, employed at our Board of Trade office, sent to 'Cx,' our New York Produce Exchange, 364 messages in three hours and 50 minutes, an average of 99.8 messages per hour. 'Cx' office sent to Operator Root, of our Chicago Board of Trade office, on the same wire, and at the same time, 350 messages, an average of 91.2 messages per hour."

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CORRESPONDENCE relating to electricity or any of its practical applications, is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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AN air of gloom pervaded the vicinity of Jackson Park, Chicago, at the hour appointed for the second attempt to hold the motocycle contest on the morning of Thanksgiving Day. It will be remembered that on the date first determined upon it was found impossible to get up enough interest in the event to induce owners of horseless carriages to enter the contest, and "postponement" was deemed advisable, as the promoters did not wish to declare the event a positive failure without further effort to make a showing. But the result was none the less deplorable. Out of 40 original entries only six equipments could be produced on the day selected for the last attempt. The appointment of John P. Barrett as one of the judges had made many suspicious of the entire project, and notwithstanding Mr. Kohlsaat's assurances that it would be conducted honestly, it seemed impossible to awaken interest in the event. The funereal gloom that marked the opening of the contest followed the paltry half-dozen starters as they wended their way northward. One after another of the carriages dropped out of line until finally one solitary carriage wended its weary way over the route, not, however, without much assistance from outsiders when it came to a stop several times on the road—mute protests against the inglorious task that had been set before it.

Many expressions of sympathy have been heard from persons who thought that Mr. Kohlsaat's enterprise should have been more fittingly rewarded. This sympathy would be more general were it not for the fact that after appointing Barrett as a judge Mr. Kohlsaat's attention was directed to the evident dissatisfaction that existed among electrical men, and Barrett's real position in the fraternity was plainly shown to him in time to allow the appointment of a satisfactory substitute. But Mr. Kohlsaat disregarded the warning and consequently he suffered the mortification of having what once promised to be an event of considerable magnitude in the scientific world as well as a good advertising enterprise, sink into the greatest fiasco of the times. It only escaped being a howling farce by being such a lamentable failure as to move one to pity rather than to merriment.

IT will surely be a great gratification to the entire electrical fraternity to receive the announcement, which the WESTERN ELECTRICIAN is authorized to make, that the only effect of the great winter storm of last Monday week on the Metropolitan elevated electric railroad of Chicago was to bring to it a greatly increased volume of traffic, due to the snow blockade of the cable roads on the surface. Through the snow, sleet and ice of the storm—and, as all western readers are aware, the elements raged in a veritable blizzard—the Metropolitan lines were operated without interruption after 4 A. M., except for a period of nine minutes, and the delay in this instance was caused by a fire under the structure, wholly unconnected with the operation of the road. This was the first great winter storm encountered since the road was opened, and it was demonstrated beyond all question that the electrical equipment was fully equal to all demands made upon it in the severest winter weather. The motors were unimpeded in operation, and the shoe contacts were able to convey all the current needed from the sleety rail; the electrical-pneumatic brakes operated successfully, and in every respect the electrical equipment sufficed to give constant and reliable service to the traveling public.

There had been some apprehension that difficulty in operation would be experienced in severe winter weather, but the result in the great storm of last week proved conclusively that an elevated electric railroad can be constantly and successfully operated during the most trying storms of a northern winter. It was a great triumph for electrically transmitted power on elevated railway structures, and affords the concluding demonstration pointing toward the speedy abolition of all steam locomotives on the elevated railroads of American cities.

ADDITIONAL communications read at the last meeting of the American Institute of Electrical Engineers on "Storage Battery Applications" are presented in this issue. In both of these contributions the conservative tone maintained commends the views expressed to those who are sincerely interested in the development of this much neglected field. Mr. Hering points out that while heretofore the principal trouble has been the fact that promoters of storage batteries have been too deeply engaged in patent litigation to devote time or money to the perfection of the accumulator, it has also suffered from the fact that it has been left almost entirely to mechanical rather than chemical experts to solve the problems that have from time to time arisen to retard its progress. Now that the conditions have changed materially and the future of the accumulator is much more promising, he expresses the belief that its immediate advancement will be more marked than ever before in its history. His communication contains some excellent suggestions that will repay careful study. Mr. Edgar's paper deals more particularly with one special instance in which storage batteries have been employed with advantage. The experience which he relates is of the most valuable kind, and while it is true that each particular case must be considered separately, it serves as an illustration of what can be done when the conditions and requirements are intelligently studied. It must be admitted, too, that while the results attained in this case are very gratifying, in fact much more so than in many other cases, this can be explained satisfactorily by the special care that was taken in studying the requirements of the problem to be solved and the evident purpose of the engineers and the financial backers of the enterprise in meeting the requirements. It is not too much to expect, either, that wherever this line of policy is strictly adhered to, equally satisfactory results will be obtained. We are especially gratified to note that these communications in every particular sustain the position which this journal has maintained upon this subject.

WE commend to the especial attention of our readers the interview with B. E. Sunny on overhead wires, particularly trolley wires, which is reproduced on another page in this week's issue. It is a conservative statement of a representative man who is thoroughly in touch with the electrical interests of the country, and is in striking contrast with the sensational ravings which "Professor" Barrett has furnished the daily papers during the last week. In the interview quoted Mr. Sunny explains the increase in the number of so-called "trolley accidents" by the fact that the street car mileage has greatly increased, the rate of speed at which the cars are propelled is much higher than formerly, the men in charge of the cars, in many instances, have not had much experience in handling motors, and the public has not been familiar long enough with the dangers attending the changes of conditions noted. As a consequence children have been permitted to play in streets through which trolley lines have passed and they have been injured not infrequently while attempting to steal rides on, or rushing heedlessly in front of, swiftly moving cars. But, admitting these facts, there is nothing in them, he contends, against the trolley; these accidents are not a result of the system; they are the natural outcome of the change in the conditions, and much as they are to be deplored they would have happened just the same had the new power been cable, steam or compressed air instead of electricity. Mr. Sunny sums up the case when he says, "Indeed, the method of propulsion has nothing to do with the question. It is a matter of speed and care entirely."

Concerning the charges made by the city electrician that damages amounting to $10,000 had been done the city wires by the overhead trolley wires in the recent storm, Mr. Sunny says that what damage was done was due to sleet, and that $500 will cover the city's loss. This, it may be mentioned, is the general impression among practical electrical men. Of course, Barrett knew absolutely nothing about the extent of the damage or the real cause, but he rushed into the newspapers with his absurd statements, raised a howl against the overhead trolley and started a boom for an underground conduit system, hoping thereby to advance his own personal schemes. Mr. Sunny recalls Barrett's experience with the Fullerton avenue loop. The underground system recommended for that road by Barrett was a complete failure. The North Chicago Street Railroad company spent many thousand dollars on this road, but was finally obliged to abandon it and put in the overhead trolley. On that occasion Barrett posed as consulting engineer. The road was a failure from the beginning, and Barrett was unable to suggest means for overcoming the difficulties that were constantly arising. Defects in the system that were pointed out by engineers before the road was built, and which Barrett said were only imaginary, at once developed and the "professor" could not find a remedy. After Mr. Yerkes had given Barrett a chance to show how little he knew about electrical engineering, he put his own experts at work and made an honest effort to develop a practicable underground system, but could do nothing with the scheme which Barrett had recommended. It was thought that after this failure Barrett would have enough sense not to bring up the subject again, but inasmuch as the "professor" is now pushing another underground system, he feels that his position as an expert in this particular class of schemes requires that an explanation be made of his failure on Fullerton avenue. Hence the cock-and-bull story of "Yerkes killing the underground conduit system," which was sent out from the office of the city electrician of Chicago last week. A more shameful perversion of a public office cannot be imagined. The daily papers are not entirely without blame either. They announced that Barrett was interested in the Brandenburg company, which is trying to get franchises through the City Council, and, knowing this, they should have been more guarded in accepting his statements, for they must have known from experience that John P. Barrett never did anything from disinterested motives in his life; that he is thoroughly incompetent to pass upon any subject requiring engineering or electrical knowledge, and therefore his condemnation of any enterprise should not be regarded as the opinion of an expert.

Barrett and those interested with him in his schemes cannot charge Mr. Sunny with being prejudiced in favor of the overhead trolley, inasmuch as the company which Mr. Sunny represents is now conducting extensive experiments in New York with an underground conduit system. We have referred to the progress made from time to time in this test and in our last issue said:

> While it is admitted that a successful underground road can be built if enough money is expended upon it, there is no doubt that considerable experimental work still remains to be done before a system is devised that can compete with the overhead trolley. It will be a matter of considerable surprise, therefore, if Mr. Crimmins extends the present system before next summer. There are many problems to be solved in the meantime, and there is no reason why the new lines should not have the benefit of the experiments now being conducted.

Mr. Sunny takes the same view of the situation. Referring to the experiments now being conducted, he said:

> They have not been operated through a winter, having been but recently completed, and much is to be learned from them between now and spring. It would be foolish in the extreme to spend a dollar on underground trolleys in Chicago until the results of a winter's operation at New York and Washington can be ascertained.

This is a common sense view of the situation and it appeals at once to all men of experience. So far as Barrett is concerned, we believe that his course throughout this discussion will be pretty generally understood. It is certainly to be regretted that the head of the electrical department of the second city of the country is not only incompetent and untrustworthy, but that he uses the influence of his position in promoting his own selfish aims and personal ventures. The story of Barrett's record, when compiled, will explain many deals of this character with which he has been connected.

## Mr. Sunny's Respects to Mr. Barrett.[1]

The published statements in the Chicago papers of the number of accidents attributable to the trolley are entirely wrong, inasmuch as the trolley, which is generally understood to be the wire carrying the current, had nothing to do with them, except incidentally. People have not been killed or injured by coming in contact with the wire itself, while every accident happening to anyone by falling from a car, being knocked down by a car, or in any other way in connection with the operation of the road, is charged to the trolley.

The number of accidents during the past year is exceedingly large by reason of the enormous increase in street-car mileage, amounting to, perpaps, 50 or 60 per cent., which extensions have been made in new territory, where the people, especially the children, were unaccustomed to the cars so near their homes, and did not exercise necessary care. Many accidents, too, have happened because of the fact that the large addition in the number of cars made it necessary to employ men as motormen who had to be taught the business. This necessarily took several months, during which time the beginners did a good deal of damage. As before stated, the accidents were not caused by the trolley wire. The fact that the cars were propelled by the overhead trolley ought not to condemn the trolley if the wire itself did not kill or injure anyone, and it did not. Perhaps the cars ran too fast, and the motormen were careless. The overhead trolley should not be blamed for this.

A car propelled by cable, mules, horses, underground trolley, storage battery, steam, or in any other way, if ran too fast, as it can be, and in charge of an inexperienced driver, can do as much injury to persons and property as can a car operated by overhead trolley. Indeed, the method of propulsion has nothing to do with the question. It is a matter of speed and care entirely and wholly. This is proved by the experience with the Broadway cable in New York. The history of the operation of that road, as portrayed by the press, would be amusing were it not for the number of broken heads, legs and arms involved. Still, no one blames the cable as a means of propulsion, and there is no suggestion that it be abandoned.

If the overhead trolley were in use on Broadway, instead of the cable, it would have been pulled down by the indignant populace long before this, because of the senseless prejudice against the trolley, and with little reason, so far as accidents are concerned. I repeat that it is a matter of speed and care, and that the means of propulsion is only accidental at best.

The overhead trolley is also blameless for the recent confusion among fire alarm, telegraph and telephone wires. The amount of damage to these wires within the trolley wire district has been grossly and purposely exaggerated. Five hundred dollars will repair the damage done the city fire alarm wires, and this damage was due entirely to sleet. There are no overhead fire alarm wires in the district between Twelfth street and Chicago avenue and the river and Ashland avenue. This district, which Professor Barrett says is all underground, is, of course, the most important, while outside of it, there are but few fire alarm wires, and there is room enough so that they can be kept away from the trolley.

The sensational statement that it will cost $10,000 to repair the fire alarm wires because of the injury done them by the overhead trolley is about as accurate as many other of the wild utterances on the subject emanating from the city hall. The damage to the extent of $500 was done by sleet entirely, and the same wrecking of wires of all kinds by sleet has occurred in Chicago at least once every three years, as far back as can be remembered. Professor Barrett knows this thoroughly, and he also knows that the telegraph and telephone people were largely influenced in putting their wires underground by the desire to avoid the money loss to property and the interruption to service occasioned by sleet storms.

The recent injury to the wires from sleet is ingeniously used as a peg on which the professor can hang his prejudice against all kinds of overhead wires. He jumbles sleet and trolleys together in his statements in a most remarkable way, so that one is justified in believing that if it were not for the presence of trolleys there would have been no sleet, and anyway the sleet did no harm—it was the trolleys.

There are no reports that any of the trolleys broke down, but the other wires, including the fire alarm, broke and fell on the trolleys. Perhaps there is some blame to be attached to the owners of the other wires—those that broke under a light sleet—for not putting them up of better and stronger material.

Professor Barrett is entitled in a measure to credit for getting telegraph, telephone and electric light wires underground in Chicago, as he claims, but he is either incorrectly reported or is talking carelessly when he says that the problem of working trolley wires underground is a much easier one than were those involving the operation of the other classes of wires. He knows differently from his own experience with the Fullerton avenue loop, which was installed practically under his superintendence, and was a failure from the start. It worked in fine, dry weather, when people did not want to ride, and promptly stopped when it rained and people needed the cars. It was found utterly impracticable to carry the heavy electric current through bare wires, in bad weather, because of the impossibility of keeping moisture out of the conduit, and, after a patient and expensive trial, lasting over a year, the attempt was abandoned, much to the relief of the citizens depending on that piece of railway for transportation. If the trial had been a success, and everything pointed to the good faith and earnestness of the parties making it, it would have speedily led to the abandoning of the cables and the adoption of the underground system by placing the trolley wires in the cable channel. The railways would by this change have cut down the cost of operation to a very large extent, for the reason that 65 per cent. of the power is required to move the cable, without a car on it, while the electric current can be distributed at a loss of only 5 per cent. The saving from the change would, therefore, be enormous, and a sufficient incentive to railways to make it, could they be sure that it would furnish as good a service as the cable.

Besides the tests made on the Fullerton avenue loop there have been but two underground systems installed in this country of recent date. They are at Washington and New York and are both in service. They have not been operated through a winter, having been but recently completed, and much is to be learned from them between now and spring. It would be foolish in the extreme to spend a dollar on undergound trolleys in Chicago until the results of a winter's operation at New York and Washington can be ascertained. Our transportation facilities are taxed severely as it is without burdening them with experiments.

When we say that the overhead trolley is unsightly, we have said all that can justly be said against it. We can be patient about that, while we cannot and will not put up with the unreliable and inefficient car service which would result from experiments with underground wires.

1. Interview with B. E Sunny in the *Chicago Times-Herald*.

## How Shall We Insulate Our Overhead Wires?

The problem indicated by the query forming the heading of this article is as old as the electric lighting industry itself. The question as to what is the safest, the most secure, the best overhead construction is always with us, always interesting and always important. Then, too, fortunately or unfortunately, according to one's point of view, there is the commercial side of the problem. The companies that are transmitting electricity through the air on wires must make money or go out of business and cease giving service that has come to be regarded as indispensable in our present-day civilization.

Is it commercially practicable to place all electrical wires beneath the surface of the ground? Only a few extremists will go to the length of making a sweeping affirmative answer to this question. If some overhead wires are bound to remain, then, what distinction shall be made as to the locality and service of permissible overhead wires, and what shall be the standard of construction? This is the problem that is slowly being worked out in all the large cities of the United States.

Surveying the whole field, it is gratifying to note a steady advancement. So rapid has been the extension of electrical enterprises in the last 15 years that much cheap, shoddy construction came into existence in all parts of the country. But it was found that hurried, ill-designed, heterogenous work in power house and line circuit did not pay, and that competent engineering and thorough, substantial construction meant a marked economy in operation. So the standard has been gradually raised; since the "boom" period of the electrical industry there have been no backward steps. There is more underground work, there is better overhead construction to-day than ever before; the public is slowly being educated to a just view of the benefits and dangers of commercial electricity, recognizing the one and learning how to avoid the other. A great improvement is gradually being accomplished, but the task in its entirety is perplexing and intricate. On its complete and satisfactory performance depends the attainment of an attitude of mutual respect and good will between the electrical corporations and the public. Every electrician should do his part in furthering this great electrical "forward movement."

It happens that two contributions bearing on this ever-present discussion were presented last week—one in Boston and one in Chicago. The former was by Captain William Brophy, the veteran electrical inspector, who addressed the Electric Potential club on "The Insulation of Overhead and Underground Circuits Having a Difference of Potential of 2,000 Volts and Over." Without indorsing all the points made by Captain Brophy, the WESTERN ELECTRICIAN gladly prints the following portion of his vigorous review of the subject under consideration:

The same insulating supports, and practically the same insulating covering of the wires, that were used for overhead circuits of five arc lights, are used on circuits of 125 lights at the present day. The same style of glass insulator that is used for telegraph circuits is used to-day for arc light circuits with a difference of potential at the dynamo of between 6,000 and 7,000 volts, and for constant potential circuits with a difference of potential of 2,000 volts throughout their entire length. The insulating covering of the wires differs in name only from that first used on the small five and 10 light circuits. That the insulation of high potential circuits has not kept pace with the increased amount of electrical energy maintained therein, no one can deny, and it is self-evident that perfect insulation will result in increased profits to electric light and power companies and increased immunity from loss and personal injury to the public.

How can this most desirable end be best attained? This is the problem to be met and solved. The manufacturers of lead-covered insulated wires and cables have succeeded in producing an insulation that meets the exacting requirements of the Boston Wire Department, viz., 20 megohms per mile per 100 volts. There is not an underground wire or cable used on high potential circuits in Boston the insulation of which does not exceed this; but the question of how long this high grade of insulation can be maintained is yet to be determined. The almost perfect insulation of underground wires and cable has already been accomplished, and the question now to be met and answered is, Can the same grade of insulation be secured for overhead circuits?

My answer is yes, if the same grade of insulation is used, and no, if the present grade of insulation and construction is continued. If the same grade of wires used in the underground circuits is used, however, I would not advise any one to adopt this plan, as the proper place for such conductors is underground; and while the cost when compared with that of overhead construction is very great, the amount of energy saved that is now lost would, I believe, pay a handsome dividend on the money invested, to say nothing of the immunity from loss and injury of the community and the absence of vexatious damage suits.

I believe that all high potential circuits should be placed underground, and I believe it can be done with ultimate profit to their owners

But we have, and will continue, I fear, for some years to come to have overhead circuits, and I come now to the question of how to construct and insulate them.

I hold that all high potential circuits should be supported on wooden poles and cross-arms, and the wires of all low potential circuits excluded from such poles; and I do not believe it best to place such wires on fixtures placed on roofs or other portions of buildings, but if they are so placed, they should be beyond the reach of persons standing or working on the roofs.

I believe the so-called insulating covering in use at the present time for high potential overhead circuits to be worse than a delusion and a snare. I believe it would be better to hang out the danger signal at once, by using bare copper wire, than to continue the use of this flimsy fraud that affords no protection to human life or property, but lures innocent people on to injury and death. Knowing the worthlessness of the material, it becomes necessary to use the best form of insulating supports. The present style of glass insulators is not what is required. Many of these insulators are only so in name. The very best grade of glass or porcelain should be used, and the double or single petticoat pattern, the form best suited to the purpose being that which will offer the greatest amount of dry surface between the wire and supporting pin. These insulators should be supported on wooden pins.

Iron poles on any part of high potential circuits should not be tolerated in any civilized community. They are a relic of barbarism that should be relegated to the scrap heap, and any attempt to patch them up only serves as a thin disguise to the danger that lurks within them. Twenty-five to 40 feet of wood between the iron and the ground means that much insulation, while 100 feet of iron only means what the glass insulator, wooden pin and cross-arm afford. The waste of energy due to the iron poles on the long circuits on which are placed 125 iron lamp poles is simply enormous—so great that in rainy weather such circuits have to be cut in halves in order to send sufficient current through the lamps. Where such circuits are placed on the modern iron and steel structures they become a source of danger to persons who have occasion to handle these or other wires on the same or other fixtures. Such circuits should not be run between the branches or through the foliage of trees, but when it cannot be avoided, the highest class of insulated wire should be used, and this encased in lead or iron. Any attempt at protecting this insulation from abrasion by covering it with tape or cotton braid is useless.

All that I have said up to this time applies with equal force to direct and alternating current circuits; but there are certain features of the latter that require separate treatment.

As you know, a difference of potential of one, two or more thousand volts exists throughout the entire length of the primary circuit and between it and the earth, so that the danger from derived circuits to ground or from one side to the other is the same at a point one or more miles distant from the dynamo as it is at the brushes. Again, it is necessary for electrical and other reasons to run the wires in parallel and close together, in order that no other wires can be placed between them, and for convenience in making connections to the different transformers. Workmen and others can hardly pass between them without coming in contact with both of them, and for this reason I consider them far more dangerous than high potential series arc light circuits. As before stated, the covering of these wires affords little or no protection to those persons in dry weather, and none whatever during or immediately after rain storms.

If these circuits are to remain above ground, they should be separated so that both cannot be reached at the same time by any person; but this would involve the changing of nearly every existing circuit and a considerable increase in the cost of constructing new ones. Rather than adopt this plan a high grade of lead-covered insulated wire should be used, and when that is done the proper place for them is underground.

The transformers should be placed beyond the reach of everyone, and also the primary wires that lead to them. The best way to do this is by placing the former in a stout wooden box, kept securely closed and well ventilated, and using high grade lead-covered insulated conductors.

I believe the time is coming when all these circuits will be placed underground, and the transformers also. Instead of placing the latter on the outer walls and roofs of buildings and in some portions of their interior, they will be placed in suitable vaults beneath the streets and sidewalks, and each one will be of sufficient size to supply a large number of lamps or motors.

The danger to life from high potential circuits comes from two causes—establishing a derived circuit from any one point thereof through the person to the ground and from the ground to some other point of the circuit, or by closing the circuit through the body.

The danger from fire is mainly due to imperfect insulation.

The placing of the wires of alternating circuits underground removes one source of danger, but adds another not heretofore considered. On such circuits a second ground is not necessary to injure or kill a person who accidentally connects any portion of one of these circuits to the ground

through himself. A person standing on or touching with one hand an iron pole, and with the other a bare or poorly insulated wire, or the iron case of a transformer that is in contact with the primary coil contained therein, will, owing to the failure of the insulation, surely receive a severe or fatal shock, although the circuit be perfectly free from "grounds." The reason for this is that the copper conductor is one and the ground the other plate of a condenser, and these plates readily discharge through any path of low resistance that is offered from one to the other. This, unlike the Leyden jar, is continually charged, owing to the alternation of the current; and the energy thus produced passes through the body of the unfortunate person who forms the connection from wire to earth, and *vice versa*.

To this cause may be laid the loss of one life at least; and in this case the circuit on which the accident occurred was clear of "grounds," with the exception of the one established by the unfortunate victim through the medium of an iron pole on which one of his hands rested, while the other grasped one of the primary wires leading to an idle transformer. Tests of the circuit just previous to the accident proved it to be clear of any perceptible leakage to ground. This fact having been established, the question of how this man lost his life had to be answered. This answer was rendered after the following test had been made. A known resistance was inserted in the wire, one end of which was connected to ground, while the other was connected to one side of the circuit. The electromotive force was measured by means of a Weston voltmeter, and it was found that a sufficient amount of energy passed over the wire and through this resistance to instantly kill.

From this you can see the necessity for the best possible insulation of the wires of these circuits and the greatest care in placing transformers, in order to prevent a recurrence of similar fatalities.

Having occupied much more of your time than I should have done, I will close this address by expressing the hope and wish that this club—a semi-scientific organization—will never hesitate to warn the public of any real dangers that may exist in connection with the transmission of electrical energy. I consider it a crime to lull the public into a sense of false security. It is equally one to needlessly alarm it.

The other contribution is from the pen of B. J. Arnold, one of the leading electrical engineers of Chicago, and appeared in the columns of the *Chicago Tribune* of November 27th. It was called out by the severe storm of the preceding Monday, which prostrated telegraph and telephone wires in all directions, causing, in some localities, dangerous "grounds" from the trolley wires. There was a great newspaper outcry against overhead wires, particularly trolley wires, based on the nonsensical, unscientific talk of Chicago's arch-demagogue and incompetent city electrician, "Professor" John P. Barrett. Mr. Arnold was also asked for his view of the situation, and he prepared the following statement, admirable for its judicial spirit and good sense:

You ask for a statement regarding the behavior of the electric wires in the city during the storm of yesterday, and the conclusions to be drawn therefrom. Both parts of this question are rather broad, and in answering I have no desire to be sensational in the least; but the indiscriminate network of wires which can be observed from the top of any one of the tall office buildings, together with the numerous evidences of liability to accident from these wires to pedestrians and street car passengers, as shown in the storm last night, makes it evident that something is lacking in the present system of construction, and that some form of remedy should be applied. In justice to the various electrical companies which are using overhead wires in the city, it should be stated that most of the objectionable construction was done at a time when the electrical business was not so well developed as it is at present, and was, at the time of installation, up to date, the result being that a large amount of money is already invested in defective construction, which must sooner or later be modified, although there is a natural reluctance on the part of any company to discontinue the use of any system of electrical distribution unless it becomes absolutely necessary to do so, either by municipal regulation or through a motive prompted by the expectation of gain in operating expenses.

Many of the electric power stations built 10 years ago are to-day being rebuilt on modern lines for the latter reason, and what is true of the power stations holds true to a large extent of the overhead work or wiring systems, and the numerous wires stretching from point to point across the tops of buildings in the down-town district of this city should be removed and a better class of construction adopted, or the wires placed underground. The electrical display in numerous places in the city yesterday was caused by the small straggling wires which run at all angles across the streets in many places becoming broken by the weight of the snow upon them, causing them to drop down upon the trolley wires, and in cases where the small wires were carrying heavy pressures these pressures were immediately transmitted to the conductors, causing the dangerous pressures to be distributed to many and unknown points throughout the city. In many instances the trolley pressure was transmitted through ordinarily harmless wires to telephones. The following facts should be borne in mind by the public when considering this subject:

First—All arc light circuits, where the lamps are run in series, such as are used in lighting streets and outlying districts of the city and in most public buildings, at present are dangerous, carrying as they do from 1,000 to 3,000 volts, depending upon the number of lamps in series, each lamp requiring from 45 to 50 volts. Many owners of buildings are now adopting arc lamps known as "incandescent arc lamps," which run in parallel on 110 volt and 220 volt incandescent circuits. It is impossible to get a shock of sufficient strength to kill from such a system.

Second—All primary wires, or the wires leading from the central stations, of incandescent alternating plants, carry from 1,000 to 2,000 volts, consequently contact with them under any condition by those not skilled in the handling of them should be religiously avoided, although the wires entering the houses are not dangerous under normal conditions, as the pressure is reduced to a safe limit before entering the houses by passing through a device called a transformer or converter.

Third—The much-abused overhead trolley wire does not necessarily carry death with it, as it operates at a pressure of 500 volts, which was established by the pioneers in electric railroad work as a pressure which the human system could stand without receiving a shock sufficient to kill. There is but one case on record, so far as I know, in which it has proved fatal to human life. This was in St. Louis, where a boy threw a wire up over the trolley wire on a rainy day and hung to the wire, standing on the rail at the same time.

Fourth—Contact with telephone or telegraph wires or fire-alarm wires is not dangerous except when these wires become crossed or in contact with either a series arc light circuit or the primary wires of an alternating circuit. When this occurs they become equally as dangerous as the above mentioned wires, and it is under these conditions that persons receive the severe shocks from telephone and telegraph instruments during rain and snow storms.

Knowing these facts the following conclusions occur to me: We cannot hold up our hands in holy horror and say that all systems of overhead electrical transmission and overhead wires must be abandoned (although we know the underground system is better for lighting circuits), for the reason that under existing conditions it is impracticable and almost impossible to abandon them; consequently, having them with us, we must repair and reconstruct on lines which will be safe to the public, and these seem to me to be as follows:

First—Prevent the stringing of any more wires of any character across the streets and tops of buildings in a haphazard manner and compel them to run underneath the streets in conduits whenever it becomes necessary to cross, as is done by the telephone and electric companies where they cross the boulevard system of the city. When it becomes necessary to string high potential wires along on the tops of the buildings or within stores or residences, let them be run in some form of insulated conduit, which will absolutely prevent personal contact with them.

Second—Where trolley wires must be strung in the streets (and as the electric railway question now stands it seems necessary for us to have trolley wires), let them be erected on center pole construction in the congested districts of the city, for by so doing they are largely removed from the liability of contact with metallic awnings, down-spouts or such wires as might come into contact with side poles, if they were used; and in case of grounds on the railroad circuit, which might prove dangerous, although not necessarily so, it will be confined to poles in the center of the streets, which are not liable to be touched by pedestrians. In this manner the public would soon learn that there is no danger from the trolley wires, so long as they keep their hands off the poles in the centers of the streets, and if straggling wires, which now cause the difficulty, were eliminated, there need be no serious accidents caused by electric railway circuits. It is possible we may have a successful underground conduit system, and in this case the objection of the overhead trolley wire would disappear, but up to date no underground road has been in operation a sufficient length of time to make it safe for a railroad company operating in the city of Chicago to install it.

Let the parties who are spending their money for new electrical improvements in this city back up the electrical constructors and the city inspection department in the attempt to remove many of the objectionable features now in existence, by spending their money to build first-class from this time forward, and much of the difficulty which has been evidenced by the recent storm will disappear from among us. Before we condemn any particular branch of the electrical industry on the ground that it is fatal to life, we should remember that the steam locomotive, the steamboat and many other important scientific steps in the advancement of the world were opposed on the same lines, and that this opposition has been overcome by the public learning that there was danger from them only under certain conditions, and to keep clear of causing these conditions.

## Telephone War In an Ohio Town.

Norwalk, O., is probably the only city in the United States whose inhabitants, to the number of at least 250, have been furnished with telephones rent—free for one year, says a press dispatch. The trouble began with the introduction of the Harrison telephone into the city. The company offered a rate considerably lower than that of the Bell Telephone company, and attracted many subscribers. When 200 people had signified their intention of using the new telephone, and the Bell company saw that it must face opposition, it made the announcement that telephones would be placed in business houses and dwellings for $1 a year. This offer at once drew a large number of subscribers, and the list of Bell telephones soon numbered about 300. New wires had to be strung, and, with the Harrison company's 250 telephones, this city of 10,000 people employed over 500 telephones. When those using the Bell telephone went to pay their yearly rental fee of $1 they were informed that it was not necessary, and receipted bills for the amount were given them. Next year the Bell company will charge for the use of its telephones. The price will be a shade less than that asked by the Harrison company. The latter did not attempt to meet the competition of the Bell company.

## When, Oh, When!

Hundreds [of students] stand ready to enlist [in the National School of Electricity] when they are convinced that the administration of the scheme shall prove as unimpeachable as are the names of its honorary faculty.—*Journal of Electricity*, San Francisco.

## The Storey Multipolar Motor.

The accompanying cuts illustrate the Storey motor, which has become well known in connection with special and direct-connected work of all kinds. This machine possesses features which are to be found in no other motor on the market, and which, combined with its light weight, make it especially applicable to telpherage systems, machine tools, emery grinders, drills, hoists, exhaust fans and all kinds of direct-connected machinery. Being entirely enclosed, it is free from all injurious effects produced by dirt and moisture, and it can be used with safety in such places as cotton and woolen mills, breweries, tanneries, sugar refineries, etc., where dust and dampness are features detrimental to other machines. It is peculiarly adapted for outdoor work, as it requires no extra especially arranged coverings for its protection.

Electrically and mechanically it is second to no machine on the market. This machine, while being four-pole,

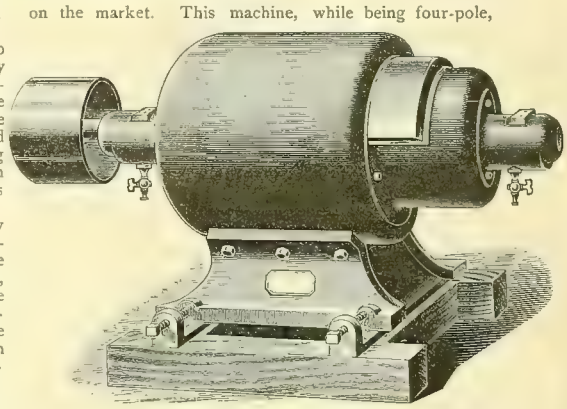


FIG. 1. THE STOREY MULTIPOLOR MOTOR.

possesses eight distinct magnetic circuits, and owing to the peculiar design every line of magnetic force is utilized, thereby producing a machine of the highest efficiency and one that has no external magnetism. The bases of all sizes are detachable, leaving the motor a perfect cylinder which can more easily be applied to combinations with other machines than any motor in use.

Fig. 1 shows the standard type of power motor, built in either shunt or series types, for slow or medium speed and for all regular or any special voltages. Among the many installations where this motor is used these may be mentioned: The Metropolitan West Side elevated railroad of Chicago, for direct driving air compressors; the American line steamships St. Louis and St. Paul, for hoists; Wm. Sellers & Co. of Philadelphia, for direct driving of tools; the Mississippi Glass company of St. Louis, for direct driving plate glass rolls; the United States cruiser Columbia, for direct driving blowers; Edward Harrington, Son & Co. of Philadelphia, electric chain hoist, etc.

Fig. 2 illustrates the standard buffing and polishing lathe, built in sizes from three-quarters to 10 horse power. This machine is to-day recognized as a standard tool by all hotel and silver men of the country. These lathes are double-ended, with long spindle shafts, which are fitted with combination buft-heads, admitting the changing of buffs very quickly. This machine is the ideal of a buffing and

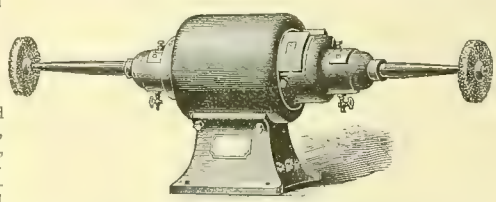


FIG. 2. THE STOREY MULTIPOLAR MOTOR.

polishing lathe—no power is wasted through shafting and belting, and no injury can result to the motor through flying dust and rouge. The best hotels in New York city have used these machines for two and three years, and have found them indispensable, saving both time and silver and maintaining a polish that cannot be obtained by hand.

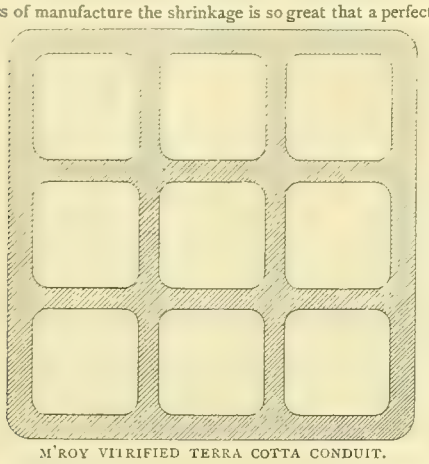
The manufacturer of these motors, the Storey Motor & Tool company of Philadelphia, has within the last year made numerous special applications in which the advantages of this type of motor are clearly shown. The Metropolitan Electric company of Chicago acts as the Chicago agent.

The Canadian Pacific Telegraph company has issued a circular announcing the opening of a new and direct connection south from Winnipeg to Minneapolis, St. Paul, Duluth, West Superior and all points south. This is the last link completing the comprehensive system of direct telegraph communication from central and northwestern Canada to all parts of the world.

## McRoy Vitrified Terra Cotta Conduit.

John T. McRoy of 36 Clark street, Chicago, is bringing to the attention of the electrical trade the new type of vitrified terra cotta conduit for underground electrical conductors which is shown in section in the cut. By using improved machinery of his own design Mr. McRoy is enabled to produce this conduit in lengths of four feet six inches and of the multiple duct design shown in the illustration. The conduit can be made with from one to 12 ducts, as desired.

The material is vitrified terra cotta, and during the process of manufacture the shrinkage is so great that a perfectly



M'ROY VITRIFIED TERRA COTTA CONDUIT.

dense mass is secured, and it is claimed that the conduit is absolutely non-porous. Not only is the terra cotta vitrified throughout, but all surfaces, exterior and interior, are glazed as an additional precaution against moisture. Another noteworthy feature is the fact that the interior of the ducts is finished perfectly smooth, with rounded edges, so that there are no projections to impede the drawing-in of the cable.

The character of construction is claimed to preclude the possibility of moisture reaching the conductors, enabling the employment of insulated wires without lead covering in the conduit. With effective insulation at the joints, which can be easily accomplished, the conduit will also serve as an efficacious protection against the ground currents escaping from trolley returns—a valuable feature in the underground construction of city streets. Inasmuch as no cement or concrete is used in connection with this conduit it, may be laid in winter as well as in summer. Theconduit may be constructed to have any cable-carrying capacity desired.

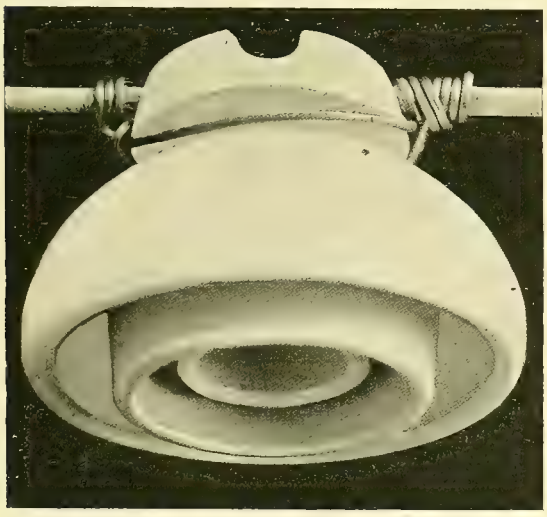
## Locke's Steel Insulating Pin and Insulator.

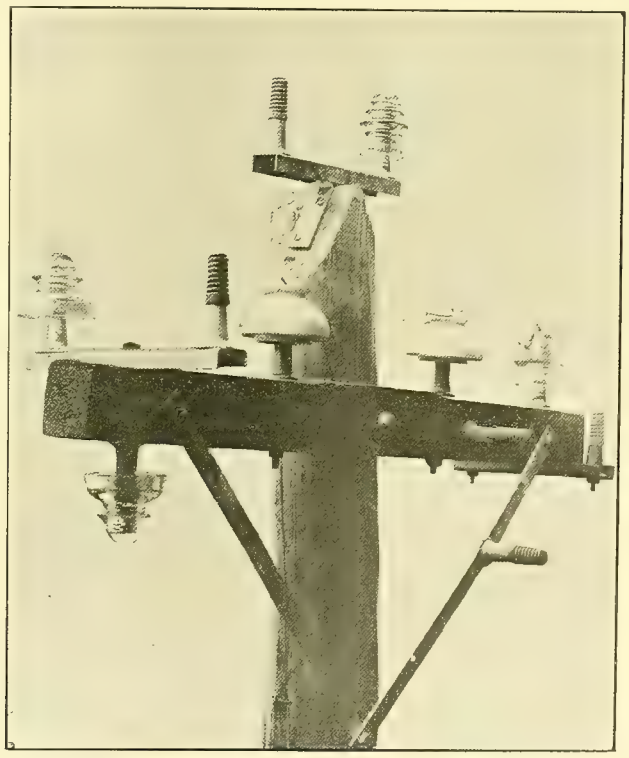
For overhead line construction Frederick M. Locke of Victor, N. Y., has brought out the excellent appliances shown in the illustration. He has designed an indestructible insulating pin supplied with a steel bolt passing from the top of the pin through a half-inch hole in the cross-arm and securely fastened on the under side by a nut and washer. The iron cap between the top of the insulator pin and the cross-arm serves as a brace to resist the strain of the pull on the pin, and at the same time covers the pin hole in the cross-arm, thereby keeping out water and moisture and preserving the arm.

The pin is practically unbreakable, and does not rot like a wooden pin. Another great advantage lies in the fact that it does not weaken the cross-arm nearly so much as the ordinary wooden pin, the difference in the diameters of the pin hole being that between one-half inch and 1¼ inch. The indestructible steel pins have been extensively used as corner pins and on long-distance transmission lines where high potentials are used. They are convenient to replace broken wooden pins, or when extra wooden pins are needed between wooden pins already in use. As shown in Fig. 2, they can be used bottom side up on the underside of a cross-arm when it is desired to add wires to a line without increasing the number of cross-arms. For iron pole fittings a three-eighth inch by five inch pin is made, which can readily be attached, and when in place is neither cumbersome, expensive nor inconvenient, as is the case when ordinaryblacksmith fixtures are used.

In the picture are shown a few of the many uses to which the indestructible steel insulator pin may be put. As will be observed the pins can be attached to the top, bottom and sides of the cross-arm, or to pole tops, break arms or to cross-arm braces. Wherever placed they present a neat appearance, and may be depended upon to resist all reasonable strains of line construction. The illustration also shows the Locke patent break arm in position under and on top of the cross-arm, also the Locke large triple petticoat porcelain insulator, triple petticoat glass insulator, transposition insulator and cable insulator.

The triple petticoat china insulator, shown in Fig. 1, is made from the highest grade chinaware. It measures 5¼ inches in diameter and four inches in height, and has over 12 inches of surface between the wire contact and the supporting pin. About 10 inches of this surface is on the under side of the insulator, out of reach of direct rainfall, where it keeps comparatively dry. The surfaces of the bottom of the insulator are perpendicular, and, therefore, catch no foreign matter. By repeated practical tests it has been found that a potential of 85,000 volts is required to puncture the insulator; hence it will carry with safety and economy any voltage that is practicable for use in the commercial application of electric power. The body and glaze of these insulators are of simple earths only, fused together into a vitreous, homogeneous mass at the greatest heat. No lead or other metallic oxide being used in making, the glaze is not a conductor. The body and glaze being of exactly the same material and fired at the same heat, the insulating qualities are as high without as with the glaze.





FIGS. 1 AND 2. LOCKE'S STEEL INSULATING PIN AND INSULATOR.

The Board of Public Works of St. Paul in its annual report says that by substituting 500 arc electric lights for about 3,000 gas lights the city can save $50,000 annually. There is considerable complaint on the quality of light now furnished, the *Pioneer Press* designating it as being of the "dim religious" variety. There is some talk of the city, putting in a plant to furnish electric light for itself, as there is but one lighting company in the city, and the chances for a low figure by advertising for bids would be small.

## Words of Appreciation.

From recent letters giving the opinions of the writers on the merits of the WESTERN ELECTRICIAN, the following selection is thought to be of sufficient general interest to merit publication:

PROF. ELIHU THOMSON, Swampscott, Mass.:
"I have always had a good word for the WESTERN ELECTRICIAN. It appears to me to be prepared in an impartial spirit and with good judgment in the selection of matter for publication."

S. M. HAMILL, general manager Brush Electric company, Cleveland, Ohio:
"As subscribers, advertisers and readers of your most excellent journal we take pleasure in stating that we have nothing but the highest praise for it."

J. H. COOKE, Monadnock block, Chicago:
"The experience of the writer is that the WESTERN ELECTRICIAN finds its way into the hands of buyers."

W. J. BUCKLEY, Fort Wayne Electric corporation, Chicago:
"The WESTERN ELECTRICIAN is one of the few electrical publications that I care to take time to read each number as it appears."

J. E. KEELYN, president Western Telephone Construction company, Chicago:
"We are pleased to express our admiration for the WESTERN ELECTRICIAN and its policy. It is a clean-cut representation of the electrical trade and deserves the good will and respect of those engaged in it."

WM. H. MCKINLOCK, president Metropolitan Electric company, Chicago:
"It gives us great pleasure to testify to the value of your publication, the WESTERN ELECTRICIAN. As an electrical newspaper, we consider it one of the best and particularly adapted to the section of the country in which it is chiefly circulated, namely, the West, the news items being crisp and helpful."

ALEX DOW, city electrician, Detroit, Mich.:
"It's a good paper. Send it to me some more. $3.10 enclosed."

G. E. FISH, city electrician, Little Rock, Ark.:
"I frequently refer to my files of the WESTERN ELECTRICIAN as far back as 1888 for information, and usually find it, which speaks for itself."

F. B. BADT, secretary and treasurer Siemens & Halske Electric company, Chicago:
"We consider the WESTERN ELECTRICIAN one of the best electrical publications in the United States. As an advertising medium we consider it excellent, especially for the western trade."

FOREE BAIN, electrical and mechanical engineer, Chicago:
"Your valuable journal, being a western production, every man, especially if he be a 'western electrician,' should be patriotic enough to appreciate it as I do, aside from its many incomparable features."

E. M. SCRIBNER, Western Electric company, Chicago:
"We have been very much pleased with results of our advertising in the WESTERN ELECTRICIAN and have no hesitation in stating that it has been a good investment. The fact that we will continue to advertise regularly may be accepted as an indication that we are perfectly satisfied."

THOMAS DUNCAN, laboratory, Fort Wayne Electric corporation, Fort Wayne, Ind.:
"The WESTERN ELECTRICIAN has been a welcome visitor to my house every week since its birth in 1887. Much in

formation and good have I received from its newsy and up-to-date columns, and I compliment it upon its tact and the attention it pays to the western interests of the electrical business."

J. POTTER, president Buckeye Electric company, Cleveland, Ohio:

"We value the WESTERN ELECTRICIAN very highly as an advertising medium and use its columns regularly, to the evident advantage of our business."

J. A. J. SHULTZ, Presidentt Shultz Belting company, St. Louis, Mo.:

"We think the WESTERN ELECTRICIAN a well gotten up paper, full of live information and useful in its line. The fact that we have been advertising with you for so long a time is evidence that our advertisement does us good."

G. D. SHEPARDSON, University of Minnesota, Minneapolis, Minn.:

"I always open the WESTERN ELECTRICIAN with interest, feeling that something fresh and valuable is in each issue. Among other features I find the news columns, especially western news, most complete."

R. W. KING, King & Charles Improved Railway Construction company, Wichita, Kan.:

"After reading the WESTERN ELECTRICIAN for three years I must say that it has become a necessity. It is a reliable up-to-date publication. I am proud of it and never fail to recommend it to my friends. Enclosed find remittance; continue my subscription."

JAMES W. THORNE, Montgomery Ward & Co., Chicago:

"It gives me great pleasure as a reader of the WESTERN ELECTRICIAN for the past six years, to say that I have always found your paper instructive, interesting and thoroughly up-to-date. To the student in search of electrical knowledge, your paper is very valuable indeed. I wish you continued success in your enterprise."

F. G. BEACH, superintendent Central Union Telephone company, Chicago:

"If I were to try and express all the good things I would like to about your paper it would throw me into brain fever. Spare me!"

J. J. DESHLER, M. D., Glidden, Ia.:

"I take great pleasure in recommending the WESTERN ELECTRICIAN to all making electricity a study."

G. L. RICE, Deering Harvester company, Chicago:

"I have taken the WESTERN ELECTRICIAN for many years and have always found its columns full of useful and valuable reading."

MONTGOMERY MEIGS, United States civil engineer, Keokuk, Ia.:

"I have long been a reader of the WESTERN ELECTRICIAN and have found it very interesting and full of information. Its illustrations and style of print leave nothing to be desired."

W. R. MASON, general manager Mason Electric Equipment company, Chicago:

"It gives us pleasure to be able to state that in our opinion the WESTERN ELECTRICIAN is one of the best mediums for reaching the entire electrical trade. It undoubtedly covers the western field to much better advantage than any other paper. We have also found that it reaches the majority of the best class of the trade throughout the entire country and abroad. We are not surprised at this, as the WESTERN ELECTRICIAN is superior, editorially as well as in general enterprise, to most of the trade papers issued. We wish you the continued success you undoubtedly deserve."

## Song of the Trolley Car.

The vivacious *Press and Journal* of Chicago credits the lively parody given below to Joseph Medill, the veteran editor of the Chicago *Tribune*, but conservative critics do not accept this estimate of authorship as correct. However, it is an amusing jingle:

I come from out the dingy barn;
I make a sudden sally,
And swiftly, caring not a darn,
Go scooting down an alley.

By jolts and jerks I bob along;
I shoot around a corner,
And subsequently sound a gong
Intended as a warner.

And from my path as on I bump,
With jar and snap and crackle,
Suburban pigs and chickens jump
With frightened squeal and cackle.

Through crowded streets down-town I rush;
I cross the muddy river;
My way through crossings jammed I push—
Men dodge me with a shiver.

'Round slippery curves I flit and flirt,
Through many a muddy puddle,
And slush from sloppy tracks I squirt
Where waiting people huddle.

Down rough and ragged roads I ride
On tracks all torn by travel;
O'er streets of granite gray I glide;
I grumble o'er the gravel.

I wind about, and in and out,
The streets and highways bossing;
I mangle many a luckless lout
Or toss him from the crossing.

No courthouse walls can stop me. Nay!
Up flights of stairs I clamber.
Trium phantly I make my way
Right through the council chamber.

So I go swiftly rolling on
By time's slow-moving river.
The horse has come the horse has gone,
But I'll go on forever.

## Effect of Lightning on the Washington Monument.

The Washington monument has again demonstrated its apparent invulnerability to ordinary attacks of lightning. It has been struck several times by discharges of atmospheric electricity without sustaining any damage, due, probably, to the fine system of lightning conductors with which the shaft is provided. As is well known, the apex of the shaft is capped with a small pyramidal block of aluminum, and up to the late storm that cloud-piercing point has escaped the bolts of electricity that have almost constantly played around and about the tall white column of marble. On a recent morning the city was visited with a heavy thunderstorm accompanied by many strokes of lightning, and one of the most vivid of these struck the aluminum point. The impact was followed by the appearance of a ball of fire shooting down the lightning rods and disappearing in the earth. The visitation caused considerable excitement at the time, which was not allayed until it was ascertained that no casualties or serious results of any kind had occurred. The matter was reported to Colonel Wilson, the engineer officer in charge of the monument, and the aluminum point was inspected as well as could be done with the aid of powerful field glasses and found to be wholly intact and unharmed. The only way in which this belief can be thoroughly established, however, is by a personal inspection of the metal, and this can be done only by sending a rigger up the outside of the shaft to its extreme tip, 550 feet from the ground. The cap of the monument has not been examined since it was first put in place several years ago, and there is considerable curiosity to see how it has stood its long exposure to the elements in its lofty perch in the clouds. It is probable that an examination will be made in the manner indicated, by sending a rigger to the top of the monument just as was done when the aluminum point was put in position.

# CORRESPONDENCE.

## New York Notes.

NEW YORK, November 30.—The Rapid Transit commissioners met on Tuesday, and the principal business transacted was the consideration of correspondence between the counsel of the board, Controller Fitch and the board itself regarding the payment of certain bills hung up by the controller, and the status of the employes of the chief engineer of the board in regard to the civil service laws.

Among the indictments returned by the Essex county grand jury to Judge Depue in Newark, N. J., on Monday, were three indictments against the two traction companies which operate the trolley roads in Essex county. Two indictments are against the Consolidated Traction company, one for illegal appropriation of a street in Belleville township on November 9th in contempt of the authority of the township committee, and the other for running a freight car loaded with ashes over the company's tracks within the limits of Newark. The third indictment is against the Newark & South Orange Traction company, for running a freight car with ashes over its tracks, and thus creating a nuisance. The indictment of the Consolidated Traction company includes one count for using its cars for advertising purposes, and there is a general count charging that the company has no legal right to use the electrical system in operating its street-car system. This last count is included in the indictments of both the traction companies. The indictment says that the running of trolley cars is entirely illegal. The general count in the indictments denying the legality of the trolley franchise was a great surprise to the people of Newark, when the substance of the indictments was made known, as there has never been any question raised as to the right under their charters of the traction companies to use electricity for power. The officers of the traction companies were also taken by surprise, and could hardly believe that the grand jury had taken such action. If the count has any basis in law the traction companies will have to defend their franchises in the courts, as the action of the Board of Works in granting the privilege to use the trolley will be taken for review to the Supreme Court. The indicted companies will be called to plead on December 10th, when they will probably admit the facts alleged, but raise questions as to the law.

Commissioner Andrews of this city has been seeking information in relation to the police telegraph systems of other cities, as the department in this city has at the present time practically nothing of that nature. From Chicago he received this information: "Chicago has a complete telephone and signal system, consisting of 887 public and 370 private boxes, operating on 81 circuits, connected with the 37 precinct stations of this department, in which they are located. The system includes public sentry boxes placed at street intersections, equipped with a signal box to transmit the number of the station; a telephone for patrolmen to report and receive orders over; a chemical register at the station which records the calls, and the necessary switches for operating the telephone and testing for electrical disturbances. The efficiency of our department has been more than doubled by the use of our telegraph system." W. F. O.

## New England News.

BOSTON, November 29. — The West End company found it necessary to issue a list of instructions to its conductors in relation to the regulation of the temperature of the cars so that all classes shall be satisfied when the mercury falls below the 50 degree notch, the point below which the law says street railroads shall be obliged to heat their cars. In referring to these rules the *Boston Herald* remarks:

It would seem that the management had gone over the ground most carefully, and provided for every emergency likely to present itself, but it is found that what suits a man of 200 pounds weight is not at all to the liking of one who tips the scales at 120. Then, again, there are the medium weights who want a little something in between. The ponderous passenger finds upon entering the car that the only seat vacant is immediately over the electrical radiator, and the moment he settles himself the prespiration begins to ooze from every pore in his body. He is not slow to inform the conductor that he is undergoing a slow process of grilling, and demands that the heat be turned off. On the other hand, the lanky passenger, who is sitting close to the crank of the front door resting his legs on the tips of toes, with collar turned up and a pink tint on the tip of his nose, happens to turn his eyes in the direction of the conductor when he is about to turn off the current and between his chattering teeth inquires if it is the intention of the company to send him to an untimely grave through the cold storage process. Again, there is the man who has made a life study of biology, and who is familiar with the ways of the microbe. He feels that the high tenperature of the cars is conducive to all kinds of disease where there is a crowding of passengers representing all conditions of city life. Then there is the man who has made a careful examination into the effects likely to follow a sudden change from a high to a low temperature without the proper precautions as advised in the popular works on hygiene.

It is learned from the West End officials that most of their cars are now provided with heating apparatus, and those which are not similarly equipped will be attended to within a few days.

It is reported that a number of Boston, Newton and Brookline capitalists are contemplating a plan for a new street railway line, to run from Newton Center to Brookline, and, later, through Newbury street, Boston, and to enter the subway at Arlington street, and that an application for a charter will soon be made. Among those who are set down as interested in the subject are William H. Lincoln, agent of Leyland Steamship company; W. A. Boland, formerly of the Thomson-Houston Electric company and late organizer and director of the Nassua Street Railway company of New York, for which he negotiated bonds for $12,000,000 when it was capitalized; Alfred D. Chandler, William I. Bowditch, Dr. Channing, Hon. M. P. Kennard, late assistant treasurer of the United States; George F. Bouve, treasurer of the Bouve, Crawford & Co. corporation and a director in the Nantasket Steamboat company, and Anson M. Lyman, all of Brookline; Thomas Gaffield, a large owner of real estate in Brookline, and Samuel Jackson of Newton.

The Railroad Electric Safety Appliance company of this city is installing a system for experiment in actual railroading on the Watertown branch of the Fitchburg line. The roadbed in general construction is divided into sections or blocks of a length contingent upon traffic and local conditions as to sidings, grade crossings, etc. Preceding the entrance to each station a small contact rail or plate is placed at each side of the track, about eight inches from and two inches above the track rail. Upon each side of every locomotive tender is placed a short trolley arm and wheel. These wheels are so located as to ride upon the contact plates. Upon every locomotive, opposite the air pump, is placed a small independently driven dynamo and an electric valve, controlling the air brake. When the trolley wheels ride upon the contact plates a current of electricity goes forward into the section upon which the train is about to enter. If the section is clear the current locks all draw-bridges, main line switches and derailing switches on sidings or grade crossings and the train proceeds as usual without any interruption. But should the section contain a train or part of a train upon the track or crossing at grade, an overhanging car on a siding, an open switch, an open or unlocked drawbridge, a broken rail, or should a bridge be burned or washed away, the air brakes are instantly and automatically applied. Should the time required to remove the obstruction extend until the next train is due, such train in turn will receive an application of the air brake and proceed under the same conditions as the former. The track is also protected at such points as may be subject to washouts and landslides. In the case of a single-track road two trains cannot enter upon a section from opposite points, even under a danger whistle, as above described, one being held upon a by-pass siding while the other proceeds. The contact plates do not extend the full length of the roadbed, but are only of such length as to insure the stopping of a train at full speed. The system is operated on a closed circuit and should the current fail through any defect in the appliance itself, the brakes are at once applied. In addition to protecting the train the system further utilizes the dynamo's current to ring station and crossing bells, thus dispensing with local

batteries, which are expensive to maintain, subject to freezing in winter and evaporation.

On Monday evening the first annual meeting of the Electric Potential club was held at Young's Hotel. Dinner was served to about 40 gentlemen. Frank Ridlon is president of the club, which is mainly made up of members of the old Boston Electric club. In a short speech he said that there was no reason why the new club should not receive generous support from the representatives of the electrical industry in New England, and introduced the speaker of the evening, Captain Brophy, who addressed the club on "The Insulation of Overhead and Underground Circuits Having a Difference of Potential of 2,000 Volts and Over." The paper was well received and an interesting discussion ensued, after which several new members were enrolled and adjournment was taken. C. S. G.

## Buffalo and Niagara Falls.

BUFFALO, November 29.—The formal petition of the newly formed Buffalo Traction company, seeking permission to lay a network of tracks in the streets of the city, has been filed with the city clerk. The aldermen have fixed tomorrow as the day for a public hearing. The South Buffalo Business Men's association has placed itself on record in favor of competition in the street railway business of this city, and resolutions looking to that end were adopted at a recent meeting. The State Railroad Commission is considering the petition of the new company for permission to construct 65 miles of additional street railway in Buffalo. The Real Estate Exchange has indorsed the plans of the Buffalo Traction company, and so has the Black Rock Business Men's association. Tom L. Johnson of Cleveland, the principal figure in the new company, says: "To even a casual observer the street railroad facilities here are very far behind the opportunities. Cleveland and Detroit, for instance, located similarly to Buffalo, have, in proportion to population, more miles and show much larger receipts per capita. Cleveland has a third more receipts and miles of tracks than Buffalo. I think that the routes laid out by the Buffalo Traction company can be operated without materially reducing the profits of the old company. What they lose in competition they make up in increased facilities."

The *Buffalo Express* has information of a contract for the equipment of the Erie canal with electric power for boats. It is stated that the Erie Canal Traction company has entered into a contract with the Erie Construction company to install a system for canalboat propulsion, from Buffalo to Albany, at an expense of $2,250,000, and that work will proceed as the work upon the canal enlargement progresses.

It is now said to be definitely settled that work on the power plant for the Canadian Niagara company will be begun within four months. It is to be pushed with all haste so that power can be furnished within the prescribed time. Mr. Rankine says that the franchise calls for the furnishing of power in 1897, but that the company will be doing so long before that time. The plant on the Canadian side of the river will be considerably larger than that on the American side.

Articles of incorporation of the Eclipse Electric Lamp company of Buffalo have been filed with the county clerk. The capital stock is $100,000, and the company is incorporated to manufacture and sell electric lamps and other electric supplies and apparatus. The directors for the first year are Thomas F. Crean, Brooklyn; Harmon H. Fulton, Elmira; William Morrison, Montclair, N. J.; Andrew Morrison, Montclair; William C. Page, New York; W. H. Crosby, Buffalo. Officers were elected as follows: Thomas F. Crean, president; William Morrison, vice-president; W. H. Crosby, treasurer. The company will occupy the third floor of the new factory building of the Spaulding Machine Screw company at Kensington avenue and the Erie Belt line. Sufficient machinery has been ordered to make 1,000 lamps a day, and it is calculated that at least 200 operatives will be needed at the outset. It is expected that the company will be turning out lamps within 30 days. The lamp is designed for bicycles, carriages and the use of miners, and will be useful wherever it is desirable to have light that cannot set fire to inflammable gases or materials. A battery designed by William Morrison will also be manufactured.

It is said that the Niagara Falls Power company is asking for bids to extend its wheel-pit to provide room for waterwheels to drive 10 generators of 5,000 horse power each. Three dynamos are already in place; three more are to be put in as soon as possible, and four others at a later date. The Pittsburg Reduction company has asked the Niagara Falls Power company for an additional 1,500 electrical horse power and the latter company has let the contract to the General Electric company for additional transformers which must be completed in four months. The joint power committee, representing the city authorities of Buffalo, has adopted the Niagara power franchise practically as reported. The entire franchise was taken up and discussed, and the only change of importance from the committee's report was to change the amount of compensation to be charged the company from 5 per cent. to 2½ per cent. of the company's gross receipts. The amendments that were tacked on the grant of the last session, when it was under consideration, were all rescinded, and the document as it now stands is in such shape that there is little doubt of its acceptance as a whole by the Niagara Falls Power company and the Niagara Falls Hydraulic Power & Manufacturing company. The power house of the latter at Niagara Falls is under construction.

The latest news from the big power house at Niagara Falls is that the current has been turned into the heaters there. There are 50 heaters in the building. They will be used to heat the buildings, and besides experiments will be made with them to determine the utility of electricity for heating purposes. A careful study will be made of it by experts, and from time to time improvements will be made. Visitors are now admitted to the gallery of the plant during the early hours of the evening, and from this point the scene is a brilliant one. Numbers of people visit the gallery and are delighted with what they see.

The contract for electrical work in the Real Estate Exchange was awarded to F. P. Jones & Co. Rotary transformers will be used in place of dynamos. The transformers will first be operated by steam engines and finally by current from Niagara Falls. F. C. P.

## Northwestern Notations.

MINNEAPOLIS, November 30.—L. C. Hendershoot has secured a verdict against the Western Union Telegraph company at Ottumwa, Ia., for $1,234.35 damages for failure to deliver a telegram promptly. Hendershoot's race horse Dexter was taken sick at Hendricks and he wired his trainer to come at once and bring a veterinary surgeon. The message was received early in the morning but was not delivered until the afternoon, when all trains to Hendricks had gone, and the trainer and horse doctor had to drive to that place. Hendershoot claims that the horse would have recovered with proper treatment, and sued for its value. There is considerable complaint from small towns in Iowa that this company does not deliver messages promptly, and the decision is received with considerable satisfaction.

The electric light and gas plant at Washington, Ia., will be enlarged.

The injunction restraining the city clerk of Appleton, Wis., from advertising for bids for lighting the city, secured by the receiver of the Appleton Edison Electric company, has been dissolved, and bids will probably be asked. This will give the new company a chance to compete for the work.

Starkey & Ketzeback of Mapleton, Minn., will put in a plant to light their mill, and contemplate a plant large enough to furnish light for the village also.

James Long of St. Vincent, Minn., is considering establishing an electric light plant at Hallock, Minn.

The light committee of the council of Seattle, Wash., has made a contract for electric lighting for six months with the privilege of six months' extension. The charter of the city does not permit making a contract for longer than one year, and the reason for limiting this contract to six months is the belief that the charter will be revised to permit a longer contract, and that a three-year contract could be made on much better terms than for one year.

A $10,000 electric light plant is projected at Mandan, N. D. The capital will be solicited principally from Mandan people.

The Mankato Gas & Electric Light company has ordered additional equipment to increase the power for the incandescent system and to furnish power for elevators, etc.

Martin T. Fleming, a lineman for the Twin City Rapid Transit company at Minneapolis, was killed by a fall from a tower wagon.

A visionary scheme is being projected to build a railroad line from Minneapolis to the northern boundary of the state via Grand Rapids, with a branch to Rainy Lake. The line would haul ore from the Mesaba iron range. Electric power would be secured from the Meeker Island dam, now being built at Minneapolis by the government, and from Rainy Lake Falls at the other end, with such sources of power as are to be found en route. The project also includes a line of barges up and down the Mississippi river. The company is to be known as the Minneapolis, Grand Rapids & Rainy River Railroad company. M.

## PERSONAL.

O. W. Meysenburg has sold his stock in the Siemens & Halske Electric company of America and will devote more of his time to the Wells & French company, of which he is president. A. W. Wright, who is now the president of the former company, is reported to have purchased Mr. Meysenburg's stock.

## ELECTRIC LIGHTING.

The electric light plant owned and operated by the Western Electric Light company of Independence, Mo., has passed into the possession of Charles Gudgell, as trustee of the bondholders. Mr. Gudgell states that it is the expectation to fulfill all of the contracts of the Western Electric Light company as soon as the plant can be brought in shape. Considerable money will have to be expended to bring about this result, as a considerable portion of the old machinery will have to be replaced with new apparatus. The Western Electric Light company took charge of the plant about nine months ago.

The Lincoln Park Board, Chicago, examined the plans of Superintendent Alexander for lighting the park at a recent meeting, but deferred action. Two estimates were submitted by Engineer Babcock. One provided for 400 new arc lights and the other for 240. The cost of one was placed at $35,000 and the other at $50 000. The larger estimate included $2,000 for a power house. The plans show lights about every 200 feet along Clark street and around the edge of the park. The interior is also well provided for. All wires are placed underground, including those which supply the 50 arc lamps now in use.

## ELECTRIC RAILWAYS.

The Sacramento, Cal., Electric Power & Light company has been incorporated to conduct a street railroad in Sacramento and also a general electrical business. The directors are Albert Gallatin, Andrew J. Ralston, Horatio P. Livermore, Charles P. Livermore and Joshua Barker. The capital stock is $1,500,000, of which $3,200 has been subscribed by each of the five directors.

C. W. Boynton has been appointed receiver of the Rahway, N. J., Electric Light & Power company. The receiver states that the inability of the company to dispose of its bonds in the market was the cause of the assignment, which has been made to protect the interests of stockholders. So far as the running of the trolley and the electric lighting is concerned there will be no change at present. There has been much regret expressed at the misfortune that has overtaken the company.

A special meeting of the stockholders of the Consolidated Electric lines of Peoria, Ill., was held at the company's offices last week for the purpose of ratifying the action of the directors at a recent meeting. The capital stock was increased from $600,000 to $750,000 and the details of the recent consolidation were perfected. Hereafter the two systems will be operated under the name of the Central Railway company. The stockholders authorized the issuing of $750,000 bonds for the purpose of taking up the outstanding bonds and improving the road. The stock of the new company is owned principally by Columbus R. Cummings of Chicago, Walter Barker, J. B. Greenhut, Samuel Woolner, Jr., George H. Littlewood and other Peorians.

## TELEGRAPH.

Mayor Latrobe of Baltimore gave the Western Union Telegraph company the alternative of paying the city tax of $5 per pole, or of having the poles cut down. The company on October 30th paid its tax ($2,296 for 1894) according to the mayor's demands.

## POWER TRANSMISSION.

The Lowell, Mich., Water & Light company has nearly completed its lines to electrically transmit 300 horse power from the Flat river at Lowell to the city of Grand Rapids. The length of transmission is about 21 miles. Along the winding course of Flat river are many heavy falls, which, if this attempt proves successful, will be utilized to generate power for distribution among other near-by cities. The full capacity of the fall now in use by the company is 1,500 horse power. Flat river is fed by nearly 100 lakes, and the volume of water is not affected to any extent by dry or wet seasons, which makes it better adapted to the use proposed than any other river in the state. "Our object," said a member of the company, "is to supply small concerns—those using from three to 15 horse power. Such plants cannot afford an engine, and, by getting their power in this way, they pay for just exactly what they use. We have no doubt of the feasibility of the scheme."

## MISCELLANEOUS.

The annual convention of the National Association of Manufacturers will be held on January 21, 1896, in Chicago.

The village of Medina, N. Y., is again confronted by the question of electric lighting. The contract with the present company, which is furnishing 61 lights until one o'clock is for $300 per month, and there is a popular demand for all-night lighting every night in the year. The common council will therefore advertise at once for bids for furnishing 55 or more 2,000 candle power arc lights for street lighting for five years from April 25, 1896, and four propositions will be asked for as follows: From dark until dawn every night in the year, from dark until 1 o'clock every night in the year, all night every night in the year except as provided by the Philadelphia moonlight schedule, and from dark until one o'clock on the same proposition. It is probable that all-night lighting every night in the year will be the closely contested proposition. The bids will be opened by the board on the regular meeting night, December 20th. The present electric light company has gotten itself somewhat into disfavor by its refusal to allow its poles for the proposed electric fire alarm wires except at a yearly rental of $100. This is considered prohibitive by the present common council, and while an alarm will be at once contracted for, its erection will be necessarily deferred until the pole matter can be adjusted. No contract has as yet been

made for a system, although the committee was given power to contract with the Rochester Signal company, if it deemed advisable. The Gamewell company is shortly to give an exhibition of its apparatus here, and it is possible that other companies will be invited to bring experimental apparatus here in competitive exhibition. A 5-cent reduction on scheduled risk rating is promised by the state board of underwriters for a satisfactory alarm system.

## TRADE NEWS.

Ralph W. Gordon, manager of the Gordon-Burnham Battery company, New York, was in Chicago for a short time and closed contracts with the Chicago, Burlington & Quincy railroad, Illinois Central railroad, Chicago & Northwestern railroad and the Northern Pacific railroad for the Gordon primary battery. The Gordon-Burnham company has met with remarkable success with its battery, which has been adopted on all branches of the Pennsylvania Railway company's lines. Mr. Gordon informed a representative of the WESTERN ELECTRICIAN that he has placed his battery wherever he has stopped, and the fact that he has found it so easy to have it adopted by Chicago's leading railway companies speaks for itself.

## BUSINESS.

The Ansonia Brass & Copper company, 19 and 21 Cliff street, New York, has issued a pamphlet devoted to the merits of Tobin bronze—the metal used in the construction of the hull of the cup defender Vigilant, and which is remarkable for its high elastic limit, tensile strength, toughness and uniform texture. It is said to be suitable for commutator bars and drop forgings of every description.

With its greatly increased warehouse and shipping facilities, the Electric Appliance company, Chicago, is able to carry an increased stock of O. K. and Paranite wires and line material. It is the purpose of the company to ship all orders for these goods from Chicago stock immediately on receipt of orders, and its present facilities enable it to do so without difficulty. The company claims that its line of everything that properly comes under the head of electrical supplies is not excelled by any supply house in the country, either in the merit of the goods or in the amount of stock carried. Among its best specialties is the Grutting electric soldering iron, for which domestic and foreign patents are now pending. After years of study and labor the Electric Appliance company now offers a practical iron for the use of tinners and other mechanics—one that is hot enough for all kinds of solder and work of all descriptions. The device is fully guaranteed and is perfectly safe.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued November 26, 1895.*

550,242. Electric Car Lighting Apparatus. William Biddle, Brooklyn, N. Y. Application filed March 7, 1895.

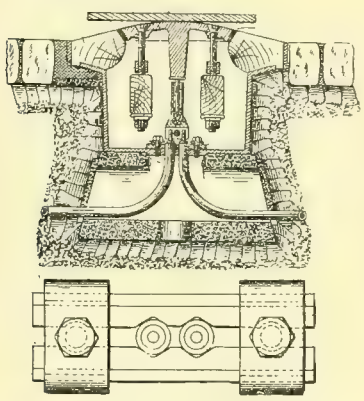
The dynamo and the secondary battery are arranged with a regulator having electrodes in a conducting liquid, and a connection is made from the regulator to the electrolytic cell for varying the current from the main line in proportion to the saturation of the secondary battery.

550,255. Apparatus for Hanging and Cleaning Telegraph or Telephone Wires. Alphons Custodis, Dusseldorf, Germany. Application filed May 15, 1895.

The combination is claimed of a pair of supports with line wires carried thereby, a pair of pulleys, an endless wire passing around the pulleys and scrapers secured to the endless wire, and adapted to engage the line wires.

550,260. Telephone Circuit Signal. Mark A. Edson, Chicago, Ill. Application filed May 20, 1895.

An electro-magnetic relay comprising an electro-magnet with a central core, an iron casing, an interposed exciting helix, and a tilting disk armature resting on its edge in front of the core are described.



NO. 550,319.

550,283. Electric Mining Machine. Edmund C. Morgan, Chicago, Ill. Application filed December 12, 1894.

An electric motor is mounted on the movable frame, a main shaft is arranged adjacent to and parallel with the armature shaft of the motor, and is adapted to be driven therefrom, a drive shaft is mounted in the movable frame, having gears thereon adapted to engage the racks, an intermediate shaft and gearing for driving the intermediate shaft from the main shaft

550,298. Electrically Controlled Clutch Mechanism. John E. Stannard, Springfield, Mass. Application filed April 5, 1895.

A power shaft, a driven shaft, a two-part clutch for coupling the shafts together, and a crank shaft having its crank operatively connected with the movable member of the clutch are combined with electrically controlled means for transmitting motion from the power shaft to the crank shaft, and means for automatically stopping the motion of the crank shaft when it has made a half revolution.

550,319. Electric Tramway with Underground Distribution of Current. Alfredo Diatto, Turin, Italy. Application filed September 18, 1894.

The cut shows a conduit inclosing the underground conductor, a series of contact plates or pieces in the top of the conduit and insulated from the ground, and provided with projections on their inner surfaces, and circuit closers comprising a bar of soft iron and a cylinder containing mercury, the circuit closers communicating with the underground conductor. There are also electrical appliances supported on a car or carriage and including a magnetized bar which is adapted to glide over aforesaid contact plates or pieces, and thus connect the plates or pieces with the underground conductor through magnetic induction from the carriage, the aforesaid circuit closers returning to the position of repose by their own weight when the magnetized bar completely uncovers the contact plates.

550,329. Electrical Pumping Apparatus. Gustaf Rennerfelt, Arvika, Sweden. Application filed July 16, 1894.

In an electrical pumping apparatus the combination is claimed with a revolving armature, of a hollow pole piece having a waterway and cylinder therein, a piston working in the cylinder, and a driving connection between the armature and piston.

550,330. Electric Pumping Apparatus. Thurs G. Rennerfelt, New York, N. Y. Application filed July 3, 1895.

An electric motor is employed, together with a series of pumping cylinders located in and forming a part of the field magnet, a piston working in each cylinder, and connected mechanism driven by the motor and common to all the pistons for actuating each piston.

550,344. Electro-locomotive. Jean J. Heilmann, Paris, France. Application filed February 13, 1895.

In an electro-locomotive the principal features are an axle and driving wheels, a frame spring supported on the axle, a motor mounted on the frame, having a hollow armature shaft encircling the axle and of an internal diameter sufficient to permit relative displacement of the axle and shaft, pairs of oppositely disposed spring buffers carried by one of the wheels within the planes of the faces of the wheel, and radial arms secured to one end of the armature shaft, each entering loosely between two buffers composing a pair.

550,354. Self-exciting Constant Current Alternator. Albert Schmid, Allegheny, and Benjamin G. Lamme, Pittsburg, Pa. Application filed August 24, 1891.

In the self-exciting electric generator described there is claimed the combination with the work-circuit coils, of main field exciting coils generating electromotive force increasing in value with increments in the work being done, and coils generating electromotive force opposed to that developed in the last-named coils, and also increasing in value with increments in the work being done, but in a less proportion than the main field exciting coils.

550,355. System of Electrical Distribution. Oliver B. Shallenberger, Rochester, Pa. Application filed October 12, 1886.

A source of alternating or intermittent currents supply conductors connected therewith in multiple arc, and one or more groups of electric converters having their primary coils connected in multiple arc with the supply conductors, and their secondary coils connected in series with each other and with the main conductors of the system, a third or neutral conductor connected with a neutral point in the group or groups of converters, and translating devices connected between the neutral conductor and each supply conductor.

550,360. Non-welding Contact. Alexander J. Wurts, Pittsburg, Pa. Application filed April 11, 1895.

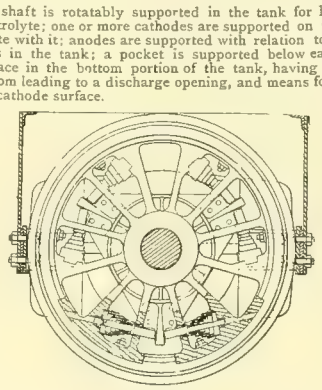
This is an electrical contact device, comprising a base or support provided with a recess, and an amalgam plug seated in the recess and projecting therefrom.

550,365. Electric Arc Lamp. Frank Emery, New York, N. Y. Application filed April 22, 1895.

There are the carbon rod and brake wheel connected to turn in harmony with the movement, a brake band applied to the wheel, and levers connected with the opposite ends of the band of a magnet, and connection therefrom for operating both the levers, and a dash-pot for cushioning the movement produced by the magnet.

550,403. Electro-depositing Apparatus. Henry L. Bridgman, Blue Island, Ill. Application filed December 22, 1894.

A shaft is rotatably supported in the tank for holding the electrolyte; one or more cathodes are supported on the shaft to rotate with it; anodes are supported with relation to the cathodes in the tank; a pocket is supported below each cathode surface in the bottom portion of the tank, having an inclined bottom leading to a discharge opening, and means for brushing the cathode surface.



NO 550,344.

550,407. Commutator. John Dice, Wilkinsburg, Pa. Application filed August 21, 1895.

This commutator has outwardly projecting flanges and grooves formed in its periphery, and a band encircling the commutator between the flanges, and adapted to retain the armature wires within the grooves.

550,411. Electric Switch. Thomas Harper, New Brunswick, N. J. Application filed August 29, 1894.

On its inner surface there are two insulated contact pieces adapted to form circuit terminals, and a carrier of insulating material movably mounted in the socket, with its surface in contact with the inner surface of the socket, the carrier being also provided with a contact piece arranged to contact with the respective contact pieces in the socket, the terminals being flush with the surfaces of the insulating material, whereby at the instant of breaking contact the insulating material adjacent to each terminal is interposed between the terminals to break any arc which may form.

550,437. Electric Railway. David Brooks, Jr., Philadelphia, Pa. Application filed February 28, 1894.

A rail is formed of a strip and a trough thereon. There are, too, an electric conductor in contact with the strip and supporting insulators, the rail and conductor being supported by the insulators.

550,464. Dynamo-electric Machine. Elihu Thomson and Merle J. Wightman, Lynn, Mass. Application filed December 2, 1889.

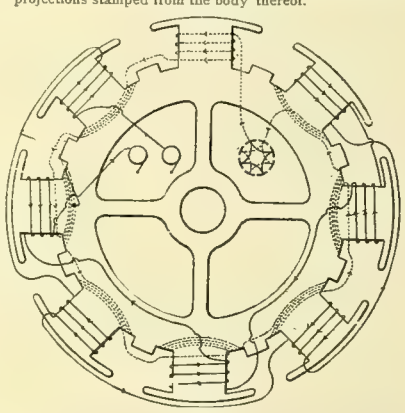
The first claim reads as follows: In combination with a series of like poles surrounding a generating structure with dead spaces intervening, an armature winding in which all the active wire at all times leads in one direction in front of the field poles and returns along another portion of the armature in a dead space between the poles before again traversing the space under a pole, and a commutator having brushes applied to collect current in such active wire.

550,465. Electric Railway. George Westinghouse, Jr., Pittsburg, Pa. Application filed June 13, 1890.

A collector for the overhead conductor of an electric railway having a lateral flange around its end and a tapering body, is one feature described.

550,468. Ventilating Means for Electrical Apparatus. George Westinghouse, Jr., Pittsburg, Pa. Application filed May 2, 1895.

A core plate for electrical apparatus is provided with spacing projections stamped from the body thereof.



NO. 550,354.

550,480. Plate for Secondary Voltaic Batteries. William A. B. Buckland, London, Eng. Application filed July 15, 1895.

Here is the claim: A plate for a secondary voltaic battery, consisting of a conducting frame having a number of parallel bars provided at intervals with flattened portions, and strips of elastic non-conducting material strung on said bars and held separated thereupon by the flattened portions of said bars, and a filling of active material covering the flattened bars and the strips strung thereupon.

550,481. Controlling Apparatus for Electro-motors. Jean B. G. A. Canet and André Hillairet, Paris, France. Application filed August 28, 1894.

Apparatus for starting, stopping and controlling electro-motors is described, comprising a stop switch, a reversing switch adapted to change the direction of current through an electro-motor, an electro-magnetic clutch having its circuit controlled by the stop switch, electric stops adapted to be operated by the body or machine, the motion of which is to be controlled and capable of breaking the circuit of the clutch, means for operating the switches and one part of the clutch, a rheostat adapted to be placed in circuit with the motor by the reversing switch and provided with a commutator, a brush carrier connected with the rotary part of the clutch, and carrying brushes arranged to travel in contact with the commutator, and means for returning the brush to its normal position when the circuit of the clutch is broken.

550,484. Electric Regulator. George W. Colles, Jr., Hoboken, N. J. Application filed February 4, 1895.

The valve of a steam engine and an electric motor geared through a longitudinally reciprocating rod, an electric circuit controller for governing the currents of the electric motor, a lever pivoted to the rod and having one arm controlling the circuit controller, and having the other arm controlled by a given device are features claimed by the inventor.

550,511. Telegraphy. Isidor Kitsee, Philadelphia, Pa. Application filed September 7, 1895.

A sending instrument is employed, consisting of the primary and secondary coil of a converter, the primary coil being localized and the secondary coil connected to the line wire. A receiving instrument consists of the secondary and tertiary coil of a converter, the secondary coil being connected to the line wire, and the tertiary coil being locally connected to a vacuum tube or a device similar in its action.

550,566. Track Instrument for Electrically Controlled Railroad Signals. Charles H. Sherwood, Utica, N. Y. Application filed December 10, 1894.

A track instrument consisting of the rock shaft is provided with a permanently affixed arm, beveled on its outer face to the top thereof, and a shoe having a socket beveled from the bottom to the face of the shoe and detachably secured to the arm.

Western Electrician.

EVERY SATURDAY.

Vol. XVII CHICAGO, DECEMBER 14, 1895. No. 24

## The New Home of the Postal Company at Chicago.

By E. J. Nally.

Because the telegraph is an older institution than the electric light or the electric railway, it is not talked about by the public as much as either of the two latter; but it is a remarkably expansive industry, nevertheless, and its business increases at a rate that compares creditably with the wonderful strides made in introducing the electric light and electric railways. The history of the telegraph is one of continual growth and progress, and when we look back a few years and remember what the telegraph was then, and consider what it is now, its enormous and rapid development becomes at once apparent.

Competition in the telegraph service, in some form or other, has existed ever since this most important artery of commerce was developed, and will probably continue to exist so long as the telegraph remains a private enterprise. Such keen rivalry for public favor as now exists between the two great telegraph companies is productive of many benefits to the public, inasmuch as it results in the best possible service at the least possible cost.

Nothing is more interesting in the history of the telegraph in this country than the wonderful progress made by the Postal Telegraph-cable company, which is all the more striking if we consider the antecedent conditions and struggles culminating in the financial panic of 1884, from which, as after a great convulsion of nature, the new era of successful competitive telegraphy begins.

The earlier consolidations in the domain of practical telegraphy, say to 1866, had been largely necessary, in fact, inevitable; but the enormous increases of capitalization due to the immediately improved prospects for business enjoyed by a company reaching everywhere, without let or hindrance, soon called new opposition into birth; and thus the Western Union Telegraph company, an aggregation created rather by commercial evolution than by the men controlling it, had to fight or absorb other companies brought into existence simply as a basis of speculation or merely to be sold out. It might be supposed that such conditions were helpful to the technical art of telegraphy, but in reality they were of little use in that respect, for one cannot point to-day to a single valuable survival of any of the ingenious plans and schemes of quick, cheap telegraphy then heralded to the world as the great desideratum.

In 1884, notwithstanding the fact that the then sole survivor in the telegraph business had only just obtained this distinction by the absorption of the Atlantic & Pacific, American Union and Mutual Union companies, the telegraph field was not free from competition, as immediately there appeared another lot of bidders for public favor in the quick transmission of news, including the Baltimore & Ohio, American Rapid, Southern, Postal, and Bankers & Merchants' Telegraph companies, between all of which there was a mutual understanding, resulting in these closely allied interests handling an immense traffic. Just how long such conditions would have prevailed, had not the year 1884 been one of financial disaster in Wall street, cannot be determined; but it is now well known how that year saw the wrecking of company after company, until all but the Postal and the Baltimore & Ohio were out of the field, and the latter would also have disappeared had it not been for the strong backing of the great railway corporation of the same name, of which that telegraph system was a part.

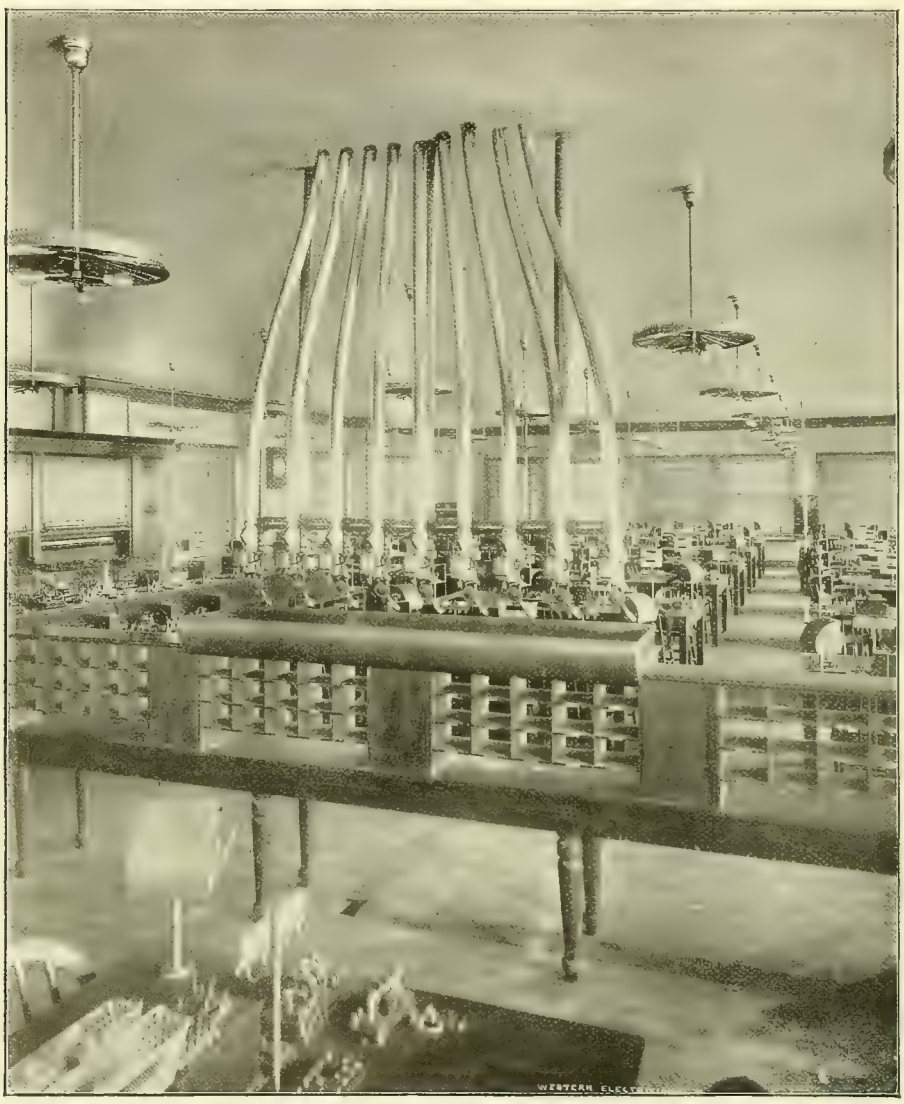
The Postal and the Baltimore & Ohio companies did not, however, long retain the distinction of being the only competing telegraph companies, as, in 1887, the Baltimore & Ohio company was absorbed by the Western Union, when the railway which built it encountered financial distress. Thus again was the field almost cleared of all competition, and a general impression created that, for some time to

THE NEW HOME OF THE POSTAL COMPANY AT CHICAGO.—OPERATING ROOM.

come, the public need expect nothing but a monopolistic tendency in this vitally important commercial necessity.

The situation was not a pleasant one for business men to contemplate; but, even before the usual results from lack of rivalry were really apparent, steps were being taken toward the extending of a then comparatively small system, which to-day is not only the largest, but the strongest, cleanest and most aggressive form of competition ever existing in the telegraph field.

It happened in the earlier days of the old Postal Telegraph company that John W. Mackay, at the solicitation of some old California friends, had taken up a block of what afterward proved to be its "insecurities," and even evinced some interest in its management. Mr. Mackay had a strong leaning toward investments aiming to benefit the public and increase commercial facilities, and it was not long before he gave another proof of his interest in such work by becoming a heavy backer of the Commercial Cable enterprise. Things looked extremely well, and the laying of the new cables proved highly successful; but the commercial collapse of 1884 left Mr. Mackay with a mass of land telegraph property on his hands in a state of shreds and chaos.



THE NEW HOME OF THE POSTAL COMPANY AT CHICAGO.—PNEUMATIC TUBES LEADING INTO OPERATING ROOM.

In this emergency he sought out, as a manager of affairs, Albert B. Chandler, a man of wide experience in telegraph matters and of conservative judgment, whom he prevailed upon to re-enter the telegraph field, which Mr. Chandler had left for that of electric lighting, at a time when the latter gave promise of its great future.

The selection was most fortunate, the conditions then existing making it absolutely necessary to have a man who had been through the successive stages of the telegraph business, from operator and manager before the war, and cipher telegrapher in the War Department during the war, to that of president of the Atlantic & Pacific Telegraph company; one who knew something, too, of up-hill fight as a manager, for in dealing then with lines called by others "united" (because that was the one quality they lacked) there was needed energy, courage, discretion and skill, as well as an intimate knowledge of the situation. Under his guidance the amelioration hoped for so earnestly soon began. The welter of debt, wreck and confusion disappeared, and Mr. Chandler was able by steady degrees of advancement, to show, chiefly by new and substantial construction, a network of land lines and a volume of business that not many months before had seemed utterly impossible.

It must be remembered that the Postal system, once so slim and trivial, now extends throughout the country. Every day sees an addition to the nearly 9,000 offices it reaches. Every day witnesses the activity of its construction gangs, so that the figures here set down of 50,000 miles of solid pole line, and more than 250,000 miles of well strung wire over which Postal messages go, will be short of the mark even before they get into type.

While the reconstruction of the land lines was being carried on, Mr. Mackay's Commercial Cable interests, which were under the able management of George G. Ward, had attained vast proportions, and the necessity of concentration of the great telegraph and cable interests resulted in the construction last year of the Postal company's magnificent modern office building at the corner of Broadway and Murray street, New York, which is the finest telegraph building, as well as one of the finest office buildings, in the world. It was peculiarly fitting that the opening of this telegraphic palace, which took place upon May 24, 1894, should mark the fiftieth anniversary of the invention of the telegraph, and it stands to-day as a splendid monument to Professor Morse's inestimable and almost indispensable gift to mankind.

Parenthetically, it may be pointed out that this steady, persistent development is natural and healthy. It is not the result of rate cutting, but is based on normal conditions. The low morality of a competition which proposes to ruin a rival by doing business at unremunerative rates, only to increase them unduly at the public expense when the rival is, haply, removed, has never commended itself to Mr. Chandler; and he has behind him a growing public sentiment against such practices. When the Postal system, with the other *disjecta membra* of by-gone organizations, fell into his hands, its rates were low, and money was being lost. As a prudent and conservative manager, to whom any idea of continuing such un-business-like methods was wholly abhorrent, Mr. Chandler took at once the first step toward fair rates, and it is, perhaps, worth recording that the initial compact, which has broadly run to this day, was effected by him with Jay Gould himself.

The completion of the Postal Telegraph building in New York was followed by a corresponding improvement in all its offices throughout the entire system, and as a result the Postal company now occupies the finest office buildings in the principal cities of North America.

The latest and best improvement in this direction is the removal of its Chicago headquarters to the Stock Exchange building, where it now has not only the best equipped, but one of the largest, telegraph offices in the world.

Perhaps the fact that the Postal company now has about 160 branch offices in this city, whereas but three years ago it had less than 40, is more comprehensively indicative of the rapid growth of the entire system than any other comparison that can be made. It is this (what in the commercial world is considered marvelous) development of a new factor in a field which was heretofore generally considered to be in the grasp of a monopoly, that has made necessary the removal of the company's local headquarters.

The move was accomplished Saturday night, December 7th, and long before these lines reach the reader's eye business in the new main office of the Postal company will be moving along as if no change in the location of this great hive of mysterious industry had occurred during the night. However, the change did take place, and despite the fact that thousands of old wire connections were cut and thousands of new ones made, everything was arranged in such a systematic manner that the other large offices of the system, which are open all night, were not even aware of the change taking place here.

How many of the thousands who use the telegraph daily, aye, hourly—and a large number use it every few minutes during 'Change hours on the boards of trade—have any idea of the complex detail that is employed in handling a telegram?

From the time the message is given to the messenger boy who responds to your call, or to the clerk who waits upon you at the counter, until it is read by the addressee at its destination, it passes through many hands. It speeds through a pneumatic tube from the receiving room to the operating department; the assorting clerk who receives it "shoots" it through another of the many tubes which form a part of the system of distribution; it is passed to the operator, who in turn transposes it from its original paper and ink into the intangible electric current of dots and dashes, and it is again transmuted into sounds at the distant end of the wire, where the receiving operator, with quick brain and nimble fingers, with the aid of a typewriter, transposes the sharp clicks of the "sounder" as it tells off the message, letter by letter, and word by word, to the familiar yellow blank, bearing a neat, clean, typewritten message—an innovation introduced by, and now one of the features of, the Postal company's service.

All this would appear to take much time, but each integer employed in its transmission is so adapted to the duties it performs that wonderful speed is accomplished. It is a common occurrence for a trader on 'Change to send to New York an order for purchase, or sale, of thousands of bushels of grain, to have the order executed and the answer in his possession within one minute.

But fine equipment, electrical and mechanical, modern improvements in apparatus and means employed by a telegraph company to expedite the handling of messages from customer to receiving department and thence to operating department avail little, unless the physical property, as its lines of poles and wires are called, is substantial and equally modern in material and construction.

The first telegraph wires erected by Professor Morse between Baltimore and Washington were of soft copper. Owing to their lack of strength and great cost they were quickly replaced by iron wires, which have been universally used for telegraph purposes until within the last fifteen years. The iron wire, in most cases, was galvanized, or coated with a thin covering of zinc, which protected the iron from rust.

The Postal Telegraph-cable company was the pioneer in the introduction and use of what is known as compound wires, consisting of steel wires on which is placed an electric deposit of pure copper. Several such wires were erected between New York and Chicago, Chicago and St. Louis, and New York and Washington, the major part having a steel core of 200 pounds, with a deposit of 500 pounds of pure copper per mile, giving a resistance of 1.7 ohms per mile. These large wires are, up to the present time, the most magnificent specimens of electrical conductors ever erected in the world by any telegraph administration, and after nearly 15 years service show, by electrical measurement and observation, no signs of deterioration.

Within the last few years the art of manufacturing what is termed "hard-drawn copper wire," has arrived at such a degree of perfection as to furnish a wire of great strength and high conducting quality, thus rendering it unnecessary

to continue the manufacture of the more expensive compound wires, which, in very small sizes, are difficult to compound in a manner to stand the strain of storms and repairs. Therefore the large additions to the original lines have been made by hard-drawn copper wires, the two between Chicago and San Francisco being 98 per cent. pure copper, 300 pounds per mile, and of a resistance of 3½ ohms per mile.

The advantage of copper wires does not lie in their being less expensive to erect and maintain, as they cost much more per mile than iron wires.

Every electrical circuit has its time constant; that is, it requires a definite fraction of a second for an electro-magnet to act at a distant station, after the operator touches his key at the sending station. As an illustration: it was computed by Professor Fleming Jenkins that the old submarine cables between Ireland and Newfoundland required two-tenths of a second between the sending of the electric current at one end and its first manifestation at the other. Such has been the improvement by increasing the copper in the present new commercial cables that it now requires less than half of that time, and double the number of words are now possible. Similarly with land wires. Iron is a magnetic substance and acts much slower than copper in the transmission of signals, and, with a given number of cells of battery an iron wire requires to be seven times heavier per mile than a copper wire to produce the same effect in an instrument; and, even then, the action will be much quicker over the copper wire. During the rain storms, therefore, the copper wires stand seven chances as against one in iron wires of carrying the signals to destination, thus rendering the telegraph between important commercial centers a more reliable medium of communication than it has ever been in the past. This result is also largely due to the vastly superior character of the poles and fixtures employed.

When these copper threads, so essential to commerce and social life, reach a great center like Chicago, it becomes highly important to arrange them in such a manner as to secure the very quickest service. First, they are brought underground from the city limits through a system of cables, each strand of which has a greater resistance than 5,000,000 of ohms between the copper wire through its insulated sheath to the earth.

The first very important matter is to have these cables, together with all the apparatus for their operation, terminate in a fireproof building. Fortunately, the new Chicago Stock Exchange has afforded an ideal location, and has provided handsome quarters that cannot be surpassed for safety, convenience, and all that is necessary for a thoroughly up-to-date telegraph office.

The electric currents necessary for the operation of the large system of wires connecting Chicago with the outer world are generated by motor-dynamos, which are located upon an iron frame in the basement of the Chicago Stock Exchange building, alongside of the superb engines, dynamos and machinery employed by the building for its own purposes. Each motor-dynamo is a double machine, the motor part being driven, or rotated, by electric current from a large building dynamo, causing the dynamo part to yield a current of a certain polarity and electromotive force for the telegraph wires, which require several different voltages as well as polarities of current. For example, a quadruplexed wire in operation involves the constant employment of one current of 120 volts positive, 120 volts negative; 360 volts positive, and 360 volts negative. Short wires need but few volts, and long circuits of 500 miles in length require as many as 200 volts at each terminal station. There are 23 of these motor-dynamos, ranging in power from 35 to 400 volts, making a complete duplicate plant. In case of failure of any one machine, another of the same power is always in readiness to take its place.

Upon the large marble switchboard, near the dynamo plant, are placed the switches and rheostats necessary for the proper government of all these machines, and the wiring is so arranged that each machine is entirely independent of the others; thus, at will, any or all machines comprising the plant may be put in service.

An iron terminal frame is conveniently located near the foot of a large shaft connecting with the operating department situated on the thirteenth floor of the building. To this frame all out-of-town and all city branch wires are first brought in lead-covered cables, which end in iron terminal heads secured to the iron frame. Also between the iron frame in the basement and the switchboards in the operating department, there are numerous 50-wire cables, the lower ends of which connect to double binding screws on slate boards, each board having 50 straps and accommodating one cable. The switchboards in the operating department have each 50 straps to receive the upper ends of the 50-conductor cables. It will now be easy to understand how the wires coming from the outside are connected at the iron terminal frame in the basement with the switchboards in the operating department.

The operating room covers, at present, nearly 6,000 square feet of floor area, and has spare room provided to extend over double that space. In this room all the wires are provided with the necessary apparatus for sending and receiving the delicate electric signal which are translated by skilled operators into letters, figures, words and sentences.

The apparatus is located upon 30 cherry octette tables, affording accommodations for 240 operators at one time. These tables are specially designed, and are provided with closets for storing the typewriters, eight in number, with which each table is equipped. Indeed, a remarkable feature

THE NEW HOME OF THE POSTAL COMPANY AT CHICAGO. —EXTERIOR VIEW OF OFFICES.

of this modern telegraph office is that pen and pencil have been entirely superseded by the typewriting machine, which, owing to the innovation established by the Postal Telegraph-cable company, has now become a necessary adjunct to the telegraph service.

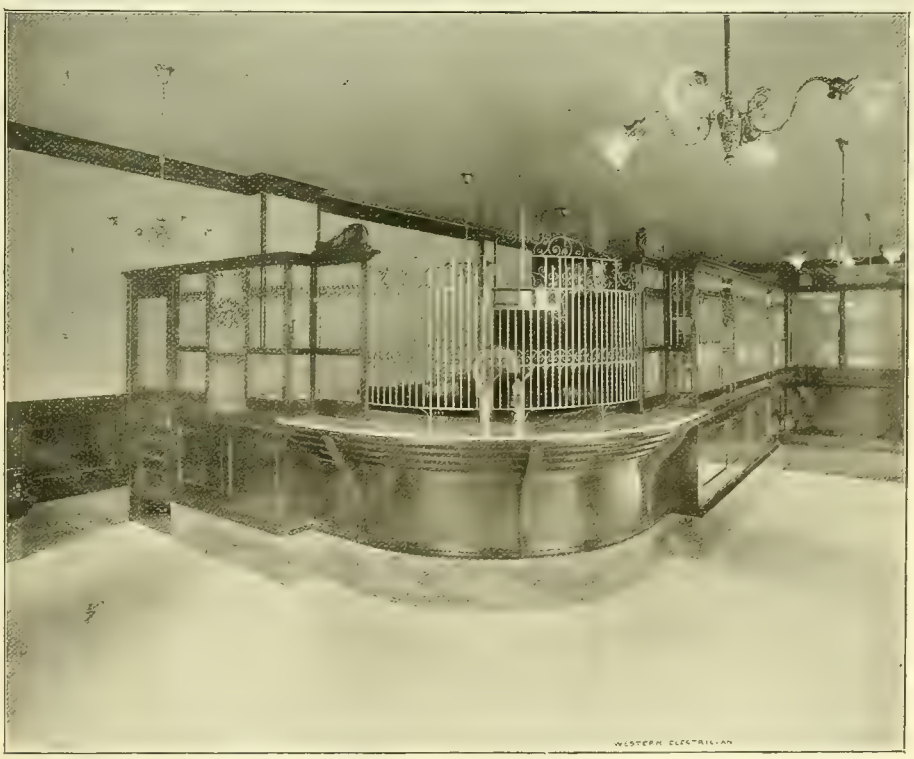
A cursory inspection of the room will impress an observer at all conversant with the past practices of telegraph companies that in hardly one thing has the Postal company adhered to long established methods. In almost every particular improvements are apparent, and in some cases the changes are startling and obvious. The tables present to the eye a clean sweep of an imposing arrangement of new and beautiful machinery. The old-style glass partitions and rails are nowhere to be seen. The instruments whose sound interprets to the ear of the receiving operator the signals constituting a message are so well screened by the "resonators" that no interference is felt between the signals arriving upon adjacent instruments.

By means of the switchboard, an imposing structure of wonderful and artistic construction, located around the angle of the light-well in the southwest part of the room, any change in the wires can be made almost instantly. It is to the switches that all wires are brought, and here, also, are the plugs and wedges that connect the wires to their respective sets of instruments located upon the tables.

The various wires and sets of instruments are perfectly interchangeable, and spare sets are kept in readiness to relieve a set that may have become inoperative from long use or accident, so that no delay may be sustained to telegrams on the circuit. At these switches, also, are stationed the chief operators, whose attention is constantly engaged in seeing to the condition of the circuits placed in their respective charge. These chiefs make tests with delicate apparatus to ascertain if the wires between Chicago and other points are free from contact with other wires or objects. So expert have they become that they can accurately locate a fault under the street in a wire that may have been injured by the pick of some careless workman digging for gas, water or other pipes.

Near, and facing one set of switchboards, is a glass partitioned table used exclusively for automatic repeaters that do not require the service of operators. For various reasons, the distance at which telegraph circuits work direct is limited to about 500 miles. As a rule, however, the sources of electric current, and the instruments at each end of a circuit are located at the principal large cities, so that wires working between Chicago and St. Louis, for instance, have dynamos at those places. Wires, however, between Chicago and New York, although worked direct, are operated by the use of automatic repeaters, located at an office midway upon a quadruplexed circuit that carries simultaneously two messages from Chicago to New York, while two messages are coming from New York to Chicago upon the same wire. This automatic repeater (located at either Pittsburg, Meadville or Buffalo, according to the route selected) receives on its western side the two Chicago messages, and, actuated by local apparatus, automatically transfers the signals over to its eastern side, where they are instantly forwarded to New York by means of a new supply of electric current generated at the repeating station; and, similarly, the two New York messages are signaled to Chicago over the same repeater at the same time, without the slightest interference.

The apparatus with which the new office has been equipped bears in almost every instance the evidence of being especially designed by the Postal company to operate its quadruplex and duplex systems, which are distinct advances upon the original Edison system, and in the case of standard instruments improvements have been made that render the action more reliable and satisfactory. Among these improvements, beside the introduction of the new systems and the resonators alluded to, are the new style aluminum lever sounders, with fixed trunnions; the displacement of milled-head thumbscrews on all instruments by the use of a neat slot-head binding-post that does not allow the wires to jar loose; the adoption of a safety-connecting three-point switch that insures perfect contact; and so on through a long list. The maxim has been adopted by the electrical engineer and endorsed by the company, that "the best is the cheapest;" and particularly is this interesting to the public as showing that no expense or pains has been or will be spared to furnish the most reliable means of handling the telegrams committed to the care of the "Postal."



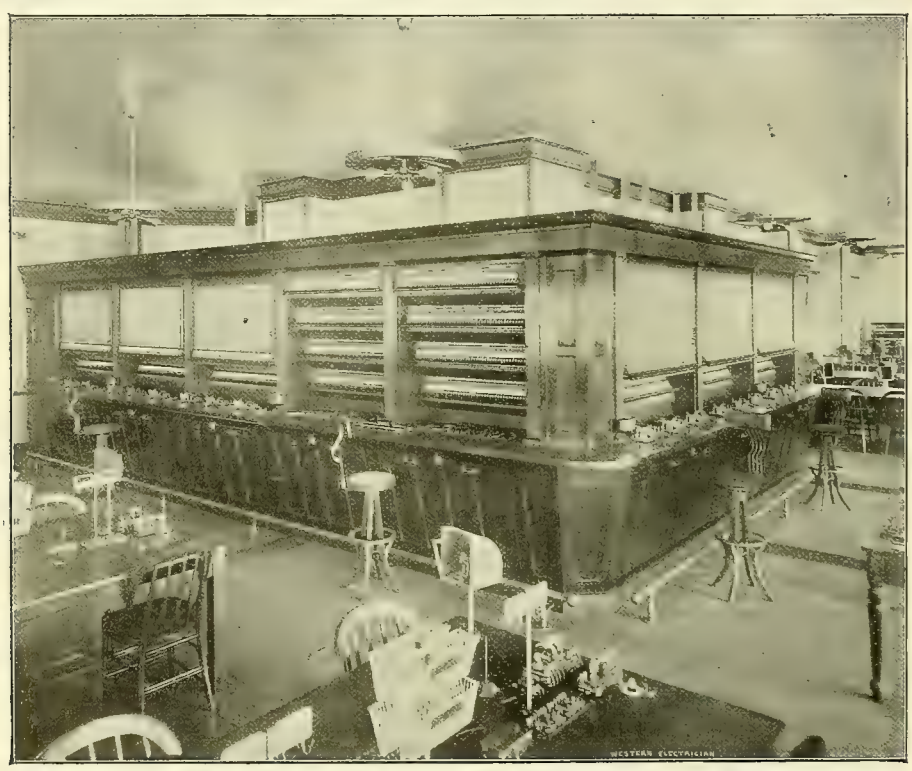
THE NEW HOME OF THE POSTAL COMPANY AT CHICAGO.—INTERIOR VIEW OF RECEIVING DEPARTMENT.

In order to quicken the service in and around the main operating room, and between the main and branch offices in Chicago, a costly and new system of pneumatic tubes has been installed. The foci of these tubes is in the center of the operating room, where all messages are received for assorting prior to distribution to the various circuits. Several tubes extend from the distributing foci to distant parts of the room, to the executive offices, the book-keeping room, the receiving and delivery departments on the first floor, and to the Board of Trade, so that the least amount of time will be consumed in the transit of telegrams between circuits. Each tube may be operated alternately in opposite directions, the passage of the carrier occupying a very brief space of time.

In the center of the room, where the tubes converge, are located the distributing clerks, at a table containing several sets of pigeon-holes open at both ends. Each set of pigeon holes is numbered to correspond to the several districts into which the office and branch offices have been divided. For example, 10 circuits and their respective tables may be included by No. 1 district. When telegrams arrive at the distributing desk from any other district for any circuit in No. 1 district, the clerk places the telegrams in No. 1 pigeon-hole, and the check clerk immediately pulls them out of the pigeon-hole at the opposite

Over 97 miles of insulated copper wire was used to make the connections between the underground cables in the basement and the switches and apparatus on the thirteenth floor, and the following additional figures will give a layman some idea of what it means to move and "connect up" a large telegraph office: Two hundred and fifty miles of wire compose the new cables pulled in the underground conduits built to connect the terminal room in the basement of the Board of Trade building with cables in the main conduits running east and south. From the Board of Trade terminal room to the terminal room in the basement of the Chicago Stock Exchange, the conduits afford space for many large 125-wire cables, with an aggregate mileage of 551.6 miles. In addition, it was necessary to pull in other cables, ranging from 10 to 60 conductor, in other conduits, equal to more than 150 miles of wire. There are more than 1,100 miles of wires in the Postal cables connecting its new office with the Union Stock Yards, where its pole lines begin.

J. F. Butterfield, assistant electrical engineer, Chicago, under the able supervision of F. W. Jones, electrical engineer, New York, planned and carried out the details of the many mechanical and electrical features which contribute to the completeness of this most complete of modern telegraph offices.



THE NEW HOME OF THE POSTAL COMPANY AT CHICAGO.—SWITCHBOARD IN OPERATING ROOM.

open end and runs to the No. 1 district with them, or, if No. 1 district is reached by pneumatic tube, they are placed in a carrier and shot through No. 1 tube, which reaches the center of No. 1 district; and similarly with messages from and to all other districts. As there are four sets of these distributing pigeon-holes, with room on both sides for the clerks, it is obvious that should the volume of business demand it, there may be four distributing clerks at work at the same time, each one assorting and distributing for all the districts.

A large Blake duplex air pump located in the engine room supplies compressed air to ample reservoirs, which feed the various tubes through small supply pipes. The air, which forces the carrier through the tube at the rate of 50 feet per second, is distributed to the tube ends from the reservoirs through the iron pipes, and is controlled by valves at the tube ends. These valves are so arranged that the act of placing the carrier in the tube end and moving a lever to hold the carrier in the tube turns on the air. This lever is held in place by a spring latch which has an electrical attachment; this attachment is connected to a trigger key, which is inserted in the distant end of the tube in such a manner that when the carrier, in passage, touches this point it closes a circuit which controls the spring latch, thereby releasing this latch, and the lever flies back, closing the air valve until such time as it is desired to send another carrier, thereby saving all useless expenditure of power, as with the automatic valves from reservoirs to pump, the pump is not working when no air is being used.

Adjoining the operating department on the thirteenth floor are the executive offices of the western division. On the southeast corner is the private office of L. D. Parker, general superintendent; adjoining is the office of E. J. Nally, assistant general superintendent; next is the general office, large and well lighted, where the accounting and auditing for the western division is done; next, the office of C. M. Baker, superintendent of construction; and adjoining is that of J. F. Butterfield, assistant electrical engineer.

All of the offices are handsomely fitted with oak furniture, and conveniently arranged in every detail, the equipment including numerous time and labor-saving mechanical and electrical devices.

Across the hall are lunch and reading rooms for the employes. A separate room, nicely carpeted and furnished, is assigned for the use of the gentler sex. Adjoining are the bookkeeping, service and file departments. Next are the rooms provided with steel wire lockers, or wardrobes, for the accommodation of both sexes. These lockers are of unique construction and design and, besides affording ventilation and insuring cleanliness, give ample security to all, as each employe carries his or her key.

On the ground floor on the corner and occupying almost the entire Washington street side of the building, with a wide frontage on La Salle street, is located the main business office of the company, comprising the receiving and delivery departments and the office of G. E. Paine, manager.

The handsome fixtures and furnishings of mahogany, of artistic design and workmanship, are in fitting accord with the equipment of the other departments, which have previously been described, and include many improvements and innovations, electrical and mechanical, tending to further the one great aim of the management to leave nothing undone to secure the best results.

The matter of providing for the public has received the most careful consideration. Comfortable settees and convenient private writing desks—a novelty for a telegraph office—are arranged about the lobby of the receiving department, making everything complete, comfortable and satisfactory.

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The illustrations give an excellent idea of the equipment—the operating room, pneumatic tube service, an exterior and interior view of the offices, the switchboard in the operating room and two views of the wiring are presented in the order named. Acknowledgment is due the *Telegraphers' Journal* for the photographs of the special wiring from which the cuts on page 287 were made. These photographs were made during the progress of the work.

## BOOK TABLE.

THE ELECTRICAL TRANSMISSION OF ENERGY: A MANUAL FOR THE DESIGN OF ELECTRICAL CIRCUITS. By Arthur Vaughan Abbott, C. E. New York: D. Van Nostrand company. 1895. Price, $4.50.

This fine volume is one of the most notable contributions to the permanent electrical literature of the year, and is perhaps the most elaborate and ambitious book yet given to the profession by a Chicago electrical engineer. It is true that science does not recognize national boundaries or sectional distinctions, but it is nevertheless a gratification to welcome such an important and useful work from the pen of a western engineer.

The author has succeeded well in covering the one branch of electrical engineering to which he confines himself—the designing of external electrical circuits—and he sets forth the results of his experience and research in this direction in an admirable manner. The book is orderly arranged, and the language is well chosen, clear and intelligible. Indeed, it should become a favorite with students, owing to its style and arrangement and the avoidance of the expressions of advanced mathematics as far as possible; yet all electrical workers will find it to be without doubt the most complete and comprehensive book in the language on the electrical circuit, if not the only one.

Mr. Abbott sticks closely to his text, as indicated in the subtitle, "A Manual for the Design of Electrical Circuits," and the scope of the book can best be indicated by quoting from the syllabus found in the preface: "The opening chapters are devoted to an outline of circuits and to an annunciation of the principles and laws governing conductors and insulators. This is followed by a discussion of the methods of constructing aerial lines and description of underground circuits and conductors. Succeeding these, a chapter is devoted to testing instruments, and one to the methods of measuring and inspecting lines, and of determining and remedying any faults that may be found to exist. In chapters vii. and viii. the laws of continuous and alternating circuits are exhibited. Subsequently, distribution proper is treated in three chapters, under the heads of 'Series Distribution,' 'Parallel Distribution' and 'Miscellaneous Methods.' In the concluding chapter a rough approximation is given for obtaining the cost of circuits and cost of the production of electrical energy." No attempt has been made to describe central station machinery, as the limits of the volume would permit only material relevant to what is, as Mr. Abbott says, "so aptly and untranslatably termed by the French *canalisation*."

The book is intrinsically interesting, aside from its value as a manual of line construction. Many extracts might be given to illustrate this quality of readableness, but the limitation of space compels us to content ourselves with one instance. Reference is made to the author's remarks on trolley conduit railways, which are especially pertinent just now in view of the outcry against the overhead trolley wires in Chicago and other cities. On page 170 he says: "Many extensive and expensive experiments have been tried with various forms of underground structures intended to carry the trolley conductor beneath the surface of the street. Generally speaking, these attempts may be so far stated to have been failures, for the difficulties encountered in securing requisite insulation, providing for surface drainage, and allowing successful contacts with the motors, have been too great for inventors entering the field. In favorable locations it is undoubtedly possible to construct a successful street railway sub-structure, yet the additional expense of the conduit is so great and the advantages to be derived from its use so few that little or no headway is likely to be made in this direction as long as the remotest possibility exists of obtaining an overhead franchise. Three or four electric roads in Europe and perhaps as many more in this country are running upon underground systems; but as yet the electrical railway conduit has hardly transcended the experimental stage." Mr. Abbott gives brief descriptions of a few of the leading conduit systems, but we are surprised at his statement that two sections of Love conduit, "one in Chicago and one in Washington," "are reported to be giving fair satisfaction." The Chicago experiment with the Love conduit was abandoned two or three years ago.

The mechanical execution of the volume is excellent. The 586 octavo pages are well printed and fully illustrated, although some of the engravings, as those of the trolley line insulators, might be reduced in size to advantage. The book has 78 valuable tables and nine large plates folded in a cover-pocket. On the whole, it is cordially commended as a valuable aid to all persons interested in the theory, construction or management of electrical circuits.

## Conflict of Steam and Electric Railroads in Chicago.[1]

The irrepressible conflict for suburban traffic between the steam and street railroads has at last broken out in Chicago. New York, Boston and Philadelphia have been for some time in the throes of the struggle, but the retarded development of the electric lines in Chicago has prevented its being felt here until the present time. The approaching opening of the Clark street electric line, furnishing a through trolley connection from down-town to Englewood has precipitated the fight, and the Rock Island road has accepted the challenge by putting on 20 new Englewood trains, reducing the fare and shortening the schedule time.

The Chicago & Eastern Illinois is on the way with reinforcements in the shape of an increased number of trains and a new schedule.

The Pittsburg & Fort Wayne is contemplating an addition to its suburban equipment.

The Lake Shore and Illinois Central roads have reduced their running time.

Every steam railroad carrying suburban passengers out of the city is awake and ready to protect its interests to the utmost.

Owing to the shorter distances of the residence centers on the south side of the city the suburban railroads running south have been the first to feel the competition of the street car lines. The Illinois Central will not acknowledge it fears the street car companies, but the Chicago City Railway company feels just as confident it will make inroads into the Central's business.

From Randolph street to Sixty-third street is eight miles by the Illinois Central's tracks. The running time of the local suburban trains on the new schedule is 25 minutes, and price of single and commutation fares is 10 cents. Eighty-six trains are run daily, having a seating capacity of 33,024 passengers.

In competition with this the Chicago City Railway company runs the two branches of the Wabash and Cottage Grove avenue cable line, with its cross-town electric feeders. The combination of the two branches shows a distance of eight miles traversed in 50 minutes for a 5-cent fare. The total number of trains run each day is 363, with a carrying capacity of 54,300 people.

The approaching completion of the Clark street electric line probably will shorten the running time to the city by street railroad from such points on the cross-town lines as Kenwood and Forty-third street, and doubtless some of the nearer suburban residents along the Illinois Central in the future will use the electric cars.

The steam railroads running to Englewood, however, have suffered much more severely. Up to a short time ago few trains, slow time and high rates of fare were the rule, until the tremendous increase of passengers on the street railroad lines running to Englewood and the consequent falling off in their own suburban traffic made the steam railroads wake up. The recent actions on the part of the Rock Island, Eastern Illinois and Fort Wayne railroads show they are now alive to the situation and that the struggle has begun in earnest.

From Fifty-first to Seventy-ninth streets the Chicago, Rock Island & Pacific railroad is in direct competition with the Chicago City Railway company's lines. Under the old schedule it ran 23 trains a day with a seating capacity of 8,832 passengers. From Seventy-ninth and Wallace streets to the Van Buren street depot the 8½ miles were covered in 30 minutes. From Sixty-second street to the city took 25 minutes. The commutation rates in the two cases are 11 and 10 cents.

Opposed to this the street railroad company has two roads, the State street cable and the Wentworth avenue trolley lines. The State street cable cars reach Madison street from Sixty-third street in 46 minutes at a cost of 5 cents. On the road are 327 trains, with a total carrying capacity of 60,900 passengers. The Wentworth avenue line takes 63 minutes to reach Adams street from Seventy-ninth and Halsted streets. It runs 166 trains, with seats for 13,600 people. The combined carrying capacity of these two roads amounts to 74,500 passengers a day, against 8,800 for the Rock Island railroad, according to the old schedule.

The Rock Island has begun an avowed competition with the street railroads. It added 21 new trains a day, practically doubling its carrying capacity. Twelve of these run only to South Englewood, or as far as the electric lines. Besides this, by abandoning Fifty-fifth, Thirty-first and Thirty-ninth street stations the running time was cut five minutes. The single fare to Englewood is now 10 cents, and the commutation rate about 6 cents.

Almost exactly the same number of Englewood passengers is carried by the Chicago & Eastern Illinois railroad as by the Rock Island. The Eastern Illinois has the right to handle all the suburban traffic over the Chicago & Western Indiana tracks from Englewood to the city. It runs 23 trains daily, with a seating capacity of 8,800 people, makes the trip from Englewood to the city in 25 minutes, and charges a commutation rate of 5 cents. Opposed to it is the Halsted street trolley line of the Chicago City Railway company. This has a running time of 50 minutes to Adams street and runs 215 trains a day, with seats for 17,600 people at 5 cents apiece.

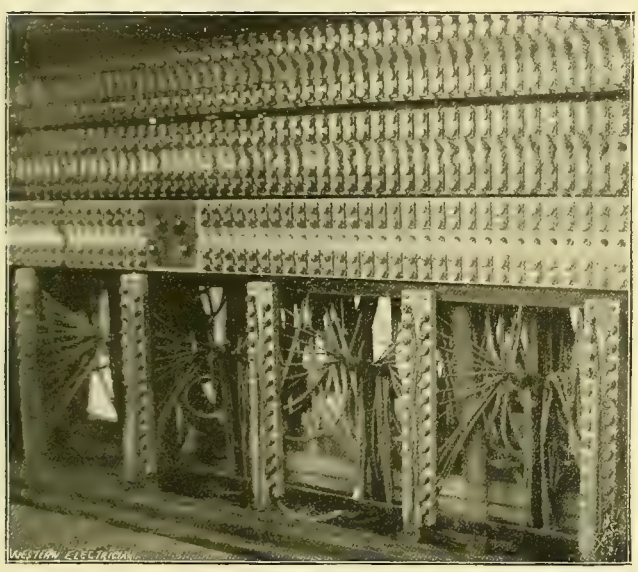
The officials of the Chicago & Eastern Illinois railroad are at work now on a new time table, which is going to show a considerable increase in the number of suburban trains.

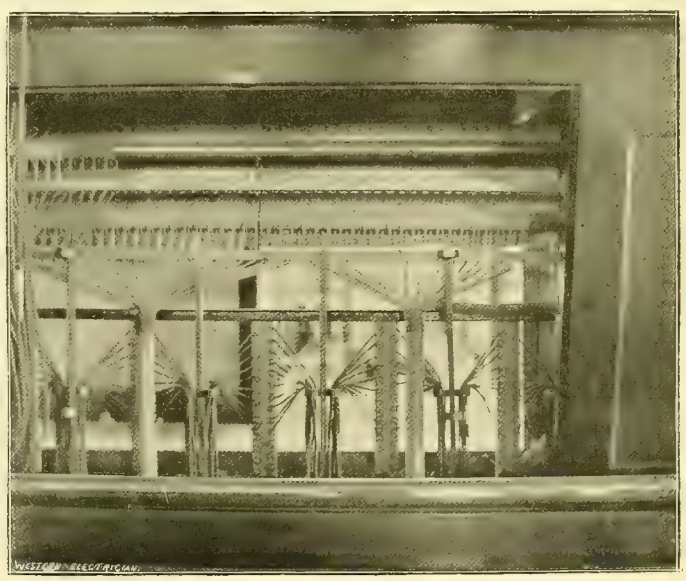
The Pittsburg & Fort Wayne and the Lake Shore railroads have the matter of increasing the suburban service under consideration.

The steam railroads running north and west from the city, according to their officers, are not bothered by the street car competition. Both the Chicago, Milwaukee & St. Paul and Chicago & Northwestern railroad officials said yesterday they had met no falling off in suburban business since the starting of the electric roads to Evanston, but rather a steady increase.

The Chicago, Burlington & Quincy railroad's executive officers also stated that owing to the distances of their first considerable stops from the city they were not bothered with street car competition.

1. From the *Chicago Daily Tribune*.





THE NEW HOME OF THE POSTAL COMPANY AT CHICAGO.—TWO SPECIMENS OF WIRING.

## Complimentary France.

Henri Marêchal, municipal engineer of roads and bridges, at a recent meeting of the French Society of Colonial Engineers, at Paris, in his address as presiding officer said: "In our depots dirty carriages with repulsive coachmen by their appearance recall the highwaymen of the olden time. In the omnibus stations a compact crowd restlessly awaits the calling of their numbers as the vehicle arrives, while upon our most beautiful thoroughfares are seen slow, uncomfortable coaches, with animals attached which plead by their appearance for pity, and deserve the attention of the Society for the Prevention of Cruelty to Animals."

After mentioning the fact that France is far in the rear of the United States in electrical achievements, the speaker added:

"We are really unpardonable! It was in a Parisian workshop that Gramme constructed the first truly electrical machine; it was a Frenchman, Fontaine, who first demonstrated that dynamos were reversible—convertible into motors—yet to America have we allowed the honor of applying these two admirable discoveries on an extensive scale.

"It is easy to say in excuse that America constitutes a territory ready prepared for the application of electrical traction. Skilled mechanics are expensive and coal is cheap. The streets there are long, wide, and straight. Administrative formalities do not prevent anyone from becoming a Vanderbilt or a Gordon Bennett, and do not demand of him that he shall indulge in the luxury of a carriage when the street car is available.

"Is it wished to open a new road? The first move, as soon as the route is settled, is to install an electric street line. Simple posts of wood support the conductors. And then, what a French engineer would consider a dishonor were it his work, are the methods of paving the road. Instead of wood blocks and granite borders, an absolutely primitive system is adopted. Planks illy arranged suffice for walks, and as to the carriage road, that is not considered—the railway is complete.

"The electric street railway is to-day a characteristic of urban life in the large American cities. It is for the common people—for the busy world—an admirable adaptation and convenience. And in those cities where the circulation is particularly congested there is no discussion as to other methods of transportation. The electric line, with its elasticity, its regularity, its capacity, exactly meets the demand of the whole people. And if the receipts of the New York metropolitan elevated lines have dropped 11 per cent., the fact is alone due to the competition offered by the electric roads.

"Think what would be the result, if in place of an elevated steam road there were a subterranean metropolitan line similar to the one promised us, if we are wise.

"That the electric railway is exactly fitted to the demands of an essentially modern need is indisputable.

"The overhead line, with its multiplicity of wires, is not considered in good form in many municipalities. Disgusted advocates of esthetic ideas in street architecture have stigmatized these overhead tangles as chicken coops."

M. Marêchal described various methods of undergrounding the conductors, and the use of storage batteries.

"I said a moment ago," continued the speaker, "that in trolley systems the current returns by the rails. Only because of economy in first cost is this preferred to the additional wire which would act as a special return. With the underground systems two wires can be run in the same conduit. The objection that the conduit becomes the receptacles for the filth of the street is invalid. At Budapest the conduit is kept in proper condition without difficulty."

M. Marêchal also cites the Love system, in which "the conductors are perfectly protected, and readily reached for repairs and inspection." and the Blackpool sytem, which he looks upon as crude and primitive. While accumulators from his standpoint have more faults than virtues for street lines. He recommends the stimulation of invention by calling on those interested from all countries to come forward in competitive exhibition of systems to supersede aerial contrivances, "and if this exposition shall bring to light some types absolutely satisfactory an enormous service will have been rendered to electrical industries."

While the general description of slipshod construction alluded to by M. Marêchal doesn't exactly fit in Chicago, it certainly does in many another American city, and if permitted would in all probability obtain here.

## Attorney-general Harmon's Recommendation in the Telephone Case.

In the first report of Judson Harmon, as attorney-general of the United States, containing a review of the operations of the Department of Justice for the last fiscal year, which was laid before Congress December 6th, attention is called to the telephone case. The attorney-general asks Congress to direct him what to do in the Bell telephone litigation. The expense of this case, he says, is very heavy. It will take six months to prepare rebuttal testimony. He favors continuing the case to a final decision, provided the expenses can be met, and says: "If the people have been deprived of their natural rights by the improper issue of a patent, as the government avers, it would not be a proper course on its part to discontinue litigation which has probably been purposely protracted until the patents have expired, but such litigation should be persisted in to establish finally, for the sake of future action on its part, its right to sue to annul patents."

The Albany, N. Y., Electric Illuminating company is making several hundred thousand dollars' worth of improvements to its plant on Trinity place. The building will be enlarged and new machinery added.

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**CORRESPONDENCE** relating to electricity or any of its practical applications, is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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**CIRCULATION, 16,630.**

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APROPOS of the articles describing the Bennett amalgamator, in which electric motors are used to facilitate the processes of gold mining by the placer method, which are appearing in the columns of some of our technical contemporaries, it may be remarked that the WESTERN ELECTRICIAN illustrated and described the first electrical amalgamator made by Mr. Bennett four years ago. The article was published January 2, 1892, and the general plan of the machine is the same now as it was then.

FURTHER evidence of the activity of the legal branch of the electrical business is furnished by a late number of the Patent Office *Gazette*, which, in the department devoted to the "decisions of the commissioner of patents and the United States courts in patent cases," prints the opinions accompanying three decisions involving electrical interests, these being the only cases noted in that number. Surely no one can deny that the great electrical concerns of the country are contributing their share to the support of the legal fraternity, but, as we have frequently pointed out, these controversies are not always conducive to the best interests of the business.

WHAT has become of the laws requiring street railway companies to provide vestibule cars during the winter months? Two years ago this subject received considerable attention, and in several states laws were passed requiring the companies operating street cars to provide suitable shelter against the inclemency of the weather for motormen, gripmen and drivers. Last year these laws were tested in Ohio and in Minnesota and their constitutionality settled beyond question; in several other states it was announced that the provisions would be respected. There the subject has rested. Very little if anything has been done toward providing suitable accommodations for the men, and already they have been compelled to undergo great hardship and suffering on account of the severity of the weather. Every human sentiment demands the enactment and enforcement of a law embodying this idea in every northern state.

IN view of the many annoyances and disappointments that the telephone is charged with inflicting upon mankind, it is really refreshing to learn that there is occasionally to be found someone who will acknowledge his indebtedness for some special benefit to this much abused instrument. A conspicuous example of this sort is furnished in the pretty little romance which the New York papers have just related of the engagement of an Indianapolis gentleman and an English girl, who have just been married. The young man in this case found that he was much more courageous when alone in Indianapolis than when in the company of the young lady in New York, so he called her up by telephone, explained the situation within the regulation "five minutes talk," and in due time was rewarded by receiving a message of acceptance from the young lady through the same channel. Now they are happily married, and they both appear to be convinced that but for the telephone their happiness would not be complete. No wonder they regard the telephone as the greatest invention of this or any other age.

WHILE there seems to be considerable doubt as to the ultimate object of several of the telephone enterprises which have been launched during the last few years, the fact should not be lost sight of that there are to-day several companies in active competition with the Bell. Readers of this journal have been kept well informed of the doings of these concerns, particularly of their operations in the West, and there is no doubt of their ability to hold their own against the old institution. It must be admitted that the West offers the best field for their operations, and possibly for that reason the attention of telephone men is so generally directed this way. The companies that give especial attention to western business are flourishing to-day; they are growing stronger and more determined in their opposition to the old concern, and the public is showing more confidence in them. It is estimated that more work has been done in extending old telephone lines and establishing new ones in this section during the last two years than in any other part of the country in the same period and in any five years previously in this territory. This record speaks for itself.

MERCHANTS on North Clark street, Chicago, are making strenuous efforts to attract the shoppers of the northern part of the city who have been in the habit of going to the South Side, where the big department stores offer special advantages. These men complain bitterly that the street is poorly lighted and that one reason why the better class of shoppers go to the South Side stores is because dissolute characters infest North Clark street at night and ply their nefarious occupations under the comparative darkness that reigns in that thoroughfare. This has given the street a bad name, and the reputable merchants are exerting themselves to overcome these obstacles to their success. They have given up the idea of getting any assistance from the city, and their experience has shown them that such lights as are provided by the city do not operate more than half the time. So they have undertaken the lighting of the street themselves, and numerous arc lamps have been placed in front of their business houses, giving the street a very brilliant appearance. No doubt the enterprise shown by the Clark street merchants will be rewarded. Their action is a strong rebuke to the city lighting scheme and shows conclusively that the people are not at all satisfied with John P. Barrett's administration.

AN event of considerable importance in local electrical circles, and of more than passing interest to the fraternity generally, is the opening of the new headquarters of the Postal Telegraph-cable company at Chicago this week, which forms the subject of the leading feature of this issue. Mr. Nally's article is a comprehensive review of the history of the Postal Telegraph and Commercial Cable projects, which is no less interesting and valuable than the technical description of the modern home which the Postal company has just equipped in this city. The policy of the Postal company commends it to the business men of the country, and it is only just to say that this corporation is entitled to much credit for having steadily improved the service, introducing reforms and innovations that have revolutionized telegraph practice. As a result the advancement noted has made telegraphy an almost entirely different occupation from that which the pioneers in this branch knew it to be. It is not necessary either to go back to the first days of the art to realize the advancement that has been made. Only a few years ago the present equipment of the Postal company, which Mr. Nally describes in his article, would be simply out of the question. For this reason alone this week's comprehensive review of what has been done is of more than ordinary interest to those engaged in electrical affairs in Chicago. It is a great achievement, both in an electrical and commercial sense.

IT might be well for those who constantly rail against the trolley, especially in the larger cities, to stop for a moment and consider the many advantages that the public have gained through the introduction of this much abused system. These advantages have not been confined to the establishment of new trolley lines or the substitution of the electric motor for the horse or mule, but the influence of this work has extended to the steam roads and cable lines. These latter companies have been forced to improve their service or discontinue it entirely, as the trolley roads have placed better facilities at the command of the people and educated them up to a higher standard. In Chicago, for example, the steam roads doing considerable suburban business have found it necessary to revise their schedules, improve their service, reduce their fares and give better accommodations generally—and all these improvements may be traced directly to the recent introduction of the trolley upon the surface lines in this city. The people of Chicago have enjoyed many advantages through the introduction of the overhead trolley system and we believe they appreciate their obligations even though some writers for the daily papers endeavor to create the impression that the public wishes to abolish the overhead trolley system. There is a good deal of silly talk about taking down overhead trolley wires, removing the poles from the streets and discontinuing the operation of the present overhead trolley systems. The best answer that can be made to such idle threats is to give those who indulge in them every opportunity to execute them. Then they would learn what the people really think of the trolley and they would doubtless be very much surprised to find that the general public has no sympathy whatever for their movement against the street railway companies. What the people do want is more trolley lines and more electric cars. They are the best that can be secured to-day and the public realizes that fact.

IT will be noticed that Mr. Yerkes, in his interview, printed on another page in this issue, calls special attention to the incompetency of the men who are generally entrusted with municipal enterprises. He deplores the presence of the politician where the expert should be found—a man with a political pull occupying a position that should be held by one selected on account of his aptitude for the place and his special training for its duties. Mr. Yerkes has had experience with the men who are now occupying responsible positions in the city government of Chicago, and his views are especially interesting at this time, as it is evident that he had in mind at the time of the interview none other than John P. Barrett. Under municipal ownership the man in charge of the street railways, Mr. Yerkes said, "would in all probability be a man who knew but little if anything about the business." His experience with Barrett had proved very conclusively to him that a political pull was of far more importance in securing and retaining such positions than expert knowledge and practical experience in the art. When Mr. Yerkes had expressed his disapproval of municipal ownership on general principles the reporter cited the water works and city lighting plant of Chicago as examples of successful city management. Mr. Yerkes' reply should be carefully considered by the business men of this community. Here is an excerpt:

> We all know there are no large industries in this city so poorly or extravagantly managed as those under the control of the city government. * * * *
>
> In our electric light department the most absurd condition is shown. This is one place where we can make a comparison between the municipal and private operation of an article used by the public. The plant of the city electrical department cost much more than it could have been built for by private corporations. In fact, the prices paid were most extravagant.
>
> The operation of the electric plant is to-day a disgrace to this community.

Everyone with any knowledge of the condition of affairs in the city electrical department must recognize Mr. Yerkes' remarks as a plain and thoroughly accurate statement of facts. Mr. Yerkes has had experience; Mr. Yerkes knows.

The "professor" is evidently becoming alarmed at the outlook, and he is attempting to divert attention from the main issue. In an interview published in an evening paper he quotes some figures upon the cost of street lighting, but inasmuch as the data presented is all wrong to start with, the conclusions drawn are of absolutely no value.

## Extravagance in Chicago's City Lighting Department.

Charles T. Yerkes was interviewed by a *Tribune* reporter upon his return to Chicago a few days ago, the subject being the municipal control of enterprises like street railway and lighting. Mr. Yerkes did not favor the idea of the city attempting the management of such projects. He said that in the street railway business the closest attention was required and that the details of management made it almost impossible for persons who had not been carefully trained in this business to conduct such enterprises successfully,

"But the city of Chicago manages its own water-works and electric light system," was suggested by the reporter, to which Mr. Yerkes thus made reply:

Yes, and we all know there are no large industries in this city so poorly or extravagantly managed as those under the control of the city government. The cost of supplying the people with water is much greater than it would be if done by a private corporation, and while we have no data in this city with which to compare the work of the Water Department yet when placed beside the cost to corporations supplying towns with water, we see how much more economical the corporation management is. There is no doubt there is enough money wasted to make a good dividend for a private corporation.

In our electric light department the most absurd condition is shown. This is one place where we can make a comparison between the municipal and private operation of an article used by the public. The plant of the city electrical department cost much more than it could have been built for by private corporations. In fact, the prices paid were most extravagant.

The operation of the electric plant is to-day a disgrace to this community. There is not another large city in the country, and I doubt if there is one in the world, where it costs so much for public lighting as in Chicago, and I know of no city where the prices are as low as those of our private corporations. Counting the interest on the plant and the cost of operating, the total cost to the city is the stupendous sum of $165 a lamp a year. There is but one thing in excuse of this extravagance, and that is the wires in the heart of the city are underground.

But allowing for this. When we compare this cost with the prices charged by private corporations in other cities the result is startling. In St. Louis the city pays the local company $74.75 a lamp a year. In Cincinnati the price is $70, and in Indianapolis $85. I have no doubt the local company in this city would be glad to make a contract to supply our light at a reduction of fully 50 per cent., providing it could make a contract for such a length of time as would warrant it in putting in an underground system in the heart of the city.

If it is not economical or practicable to operate these industries by the municipality, there can be only one reason why it should be done, and that is to support an army of politicians and their supporters, who, we all know, care little for work and who are of no service to the industry they may pretend to be engaged in. Suppose the street railway systems of Chicago were turned over to the city, who would operate them? Perhaps the commissioner of public works or his superintendent of street railways, a person who must have a political pull to be appointed to the position. He would, in all probability, be a man who knew but little if anything about the business.

Then who would be his employes? The conductors, gripmen and motormen would be the people who were valuable in the different wards in times of election. These thousands of conductors, who are really the cashiers for the railways, would be men who owed their position to the head of the department or the alderman of their ward. The situation, while serious to contemplate, would be laughable.

Then what a power it would give the political party in control! The North and West Side street car systems, together with the elevated and branch lines, employ 6,000 men. The other lines perhaps 4,000 more, making a total of 10,000 in the city. At election time every man would know a change of administration meant his probable discharge. Then, again, if it were necessary for the administration to have more votes, at least 50 per cent. more people could be placed in positions as extra men, and for other purposes.

The best object lesson of this sort of thing I know of was given in Philadelphia when the municipality purchased and ran the gas works of that city. For 25 years the trustees of the city gas works practically ran the city. The law provided the council should elect the trustees who managed the gas works. But the trustees nominated and elected the council. It was a difficult matter for anyone to be a member of the council unless he had the approval of the gas trustees.

The establishment of corporations composed of the people to manage the business interests of this country was one of the first practical steps in establishing a free government—a government of the people, when they could band together to organize manufacturing concerns, transportation companies and any industries which require large amounts of capital. As the country has grown, the demand and necessity for the enlargement of the powers of corporations has grown also. They are owned by the people, as they should be, and every man or woman who has the ability can be an owner in them.

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On Thursday evening, December 19th, Prof. A. E. Dolbear will lecture before the Electrical Section of the Franklin Institute, Philadelphia, on "Mechanical Conceptions of Electrical Phenomena."

The new plant of the Vicksburg, Miss., Electric Light company is in operation. It has one 250 horse power and one 125 horse power engine, and a local paper praises the former by saying that it "moves so smoothly that a passer half a block away can scarcely distinguish the whir of its perfect mechanism."

## Telephone News from the Northwest.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

The Lake Superior Telephone company is giving tests of its instruments at Duluth, Minn., with favorable results. The ticking of a watch was heard; a voice 17 feet from the instrument was audible; and when the mouthpiece of the telephone was entirely covered with the hand a speaker nine feet away was heard plainly at the other end. Mayor Lewis refused a request of the company to connect with the city apparatus for testing purposes, and stated that he did not believe in granting franchises gratis.

The Marquette County Telephone company is putting in new automatic switchboards at Negaunee, Mich. The Standard Telephone company of Madison, Wis., is furnishing the boards.

About 100 telephones were burned out at Ottumwa, Ia., by a crossed wire, doing about $300 damage.

The Wausau and Merrill, Wis., home telephone companies have agreed to build a toll line to connect the several towns in the Wisconsin valley at an early date, to make them independent of the toll line of the Wisconsin Telephone company. The construction of the line between Wausau and Merrill is to be begun at once.

A company has been formed at Mound City, S. D., to build a line to Eureka, S. D.

Maurice Auerbach of St. Paul, who is interested in the Standard Telephone company at that place, says that preliminary work will probably be started there in 30 days.

Enterprising citizens of Jerico, Ia., are endeavoring to secure telephone connection with some of the systems which cover the northeastern part of that state.

The city of Sheboygan, Wis., has secured a temporary injunction restraining the Wisconsin Telephone company from erecting any more poles to extend its lines within the city. The company is not enjoined from repairing its present line, nor from replacing old poles with new, but it cannot do anything further. The case was started by the council refusing the company a franchise, whereupon the company began to extend its lines. The injunction is continued until further orders from the court. An appeal will be taken by the company.

George W. Cornwell of Sturgis, S. D., representing the Harrison Telephone company, is building a telephone line toward Deadwood, S. D., and proposes to connect with Fort Meade, Sturgis, Deadwood, Whitewood, Central and Lead, S. D. He will make a rate of $2.50 for the entire system per month, if he can secure 500 subscribers.

## Work of Electric Railway Companies in Massachusetts.

The annual meeting of the stockholders of the West End Street Railway company of Boston was held on November 26th in Wesleyan Hall. There were about 75 shareholders present. The surprise of the meeting was the announcement that Henry M. Whitney, who has so long been indentified with the history of the company, had signified a desire to withdraw from the directory. With the retirement of Mr. Whitney and the death of Eben D. Jordan there are two vacancies created in the board, leaving but 13 names on the directory. No new names were added to fill these vacancies, and the shareholders voted upon the names of the members of last year's board. The address of President Samuel Little was as follows:

The eighth annual report of this company, a copy of which has been mailed each stockholder, containing, as it does, full particulars as to the financial condition of the company by the auditor, and the report of the board of directors somewhat in detail, giving the operations in departments not set forth in the report of the auditor, makes it quite unnecessary for me to detain the meeting in the way of any further report. As will be seen by the report of the auditor, the business of the company shows a considerable increase over the preceding year; also that large additions have been required to be made to the property of the company, while it will also be seen by the report that the net addition, as charged on the books of the company, has been quite small. The change from horse to electric cars brought with it a great change in the value of much of the equipment thrown out of use, which stood upon the books of the company as an asset beyond its present value. Several unused pieces of tracks, which also stood as an asset, have been removed. The conservative policy of the board led them to treat these items, together with accounts of doubtful value, as a proper charge to expenses or the surplus account, rather than to carry them on the books of the company at figures beyond their value. An item of some $82,000 for track improvement, brought forward as per last year's report, has been charged to the accounts of this year, and the track improvement of the present year, which has been large, has been treated as an expense and charged to the business of the year. While the company has been and will be called on to incur large expense in cooperation with the city in the partial construction of the reservation for tracks in several of the avenues in process of completion, the directors have felt warranted in authorizing such expenditures, believing it was in the interest of the public and the company.

Since the closing of the report of the directors, our late esteemed associate, Eben D. Jordan, has been taken from us. Mr. Jordan, who had been a member of the board of directors since 1888, died November 15th. His failing health had for some time prevented him from taking an active part in the management of the road. Those who have been associated with him in this board in the years when he felt able to bring to his large and varied interests that energy which so marked his successful and active business life will remember with pleasure his deep interest in the welfare of the company and the value of his counsel and advice. Under date of November 6, 1895, a letter was received from Henry M. Whitney requesting that his name should not be placed upon the list of directors for the ensuing year.

After the address of the president two resolutions, touching upon the matter of issuing bonds for the purpose of refunding indebtedness, were adopted. The directory elected was as follows: Alfred Bowditch, G. T. W. Braman, F. L. Higginson, William Hooper, Albert C. Houghton, Walter Hunnewell, Henry D. Hyde, Samuel Little, Theophilus Parsons, Samuel Spencer, Walter S. Swan, B. Rodman Weld and Alfred Winsor. Just 112,394 votes were cast.

The following summary of the eighth annual report (September 30th) will be interesting:

| | | |
|---|---|---|
| Gross earnings.....(Increase $922,291.68) | | $7,746,170.77 |
| Operating expenses..(Increase 826,080.09) | | 5,633,163.19 |
| Net earnings.....(Increase $96,211.59) | | $2,113,007.58 |
| Taxes | 325,288.49 | |
| Interest and rentals of leased roads | 421,674.82 | |
| Total fixed charges | | 746,963.31 |
| Balance available for dividends | | $1,366,044 27 |
| Against which the dividend charges were as follows: | | |
| 8 per cent. dividend on preferred stock | $512,000.00 | |
| 3 per cent. dividend on common stock, paid April 1 | 272,550.00 | |
| 3½ per cent. dividend on common stock, to be paid Oct. 1 | 317,975 00 | 1,102,525.00 |
| Balance of income for the year | | $263,519.27 |
| Against which are charged value of tracks taken up and bad debts, etc., written off, as shown in the auditor's statement of surplus account | | 222,822.94 |
| Balance of net income carried to the surplus account | | $40,696.33 |

GENERAL BALANCE SHEET.

*Construction, Equipment and Real Estate.*

| | | |
|---|---|---|
| Construction | $5,952,893.33 | |
| Real estate | 4,659,572.50 | |
| Power stations (buildings and equipment) | 3,276,315.31 | |
| Electric car houses and shops (buildings and equipment) | 1,660,894.80 | |
| Electric line equipment | 1,620,908.28 | |
| Cars (2,268) | 5,253,796.90 | |
| Horses (857) | 64,275.00 | |
| General equipment | 436,601.28 | |
| Total cost of road, equipment and real estate | | $22,925,257.40 |

*Sundry Items.*

| | | |
|---|---|---|
| Malden & Melrose Railroad Co. | $214,519.83 | |
| Somerville Horse Railroad Co. | 300,383.98 | |
| Furniture and fixtures | 10,378.24 | |
| Stocks and bonds | 39,450.00 | |
| Total sundry items | | 564,732.05 |

*Cash Assets.*

| | | |
|---|---|---|
| Cash on hand and in bank | $874,176.17 | |
| Cash with Trust Co. for dividend to be paid Oct. 1 | 317,975.00 | |
| Material and supplies | 361,278.55 | |
| Accounts receivable | 523,613.77 | |
| Insurance | 1,425.67 | |
| Total cash assets and accounts | | 2,078,469.16 |
| Total assets | | $25,568,458.61 |

*Capital Stock.*

| | | |
|---|---|---|
| Common stock | $9,085,000 00 | |
| Preferred stock | 6,400,000.00 | |
| Total capital stock | | $15,485,000.00 |
| Total funded debt | | 8,795,000.00 |
| Current liabilities | | 657,648.34 |
| Total sundry items | | 560,758.34 |
| Surplus | | 70,051.93 |
| Total liabilities | | $25.568,458.61 |

EARNINGS AND EXPENSES.

*Gross Earnings.*

| | | Increase over previous year. |
|---|---|---|
| From passengers | $7,624,276.62 | $889,965.50 |
| Rent of tracks | 26,577.52 | *1,820.70 |
| Sales of manure | 2,661.30 | *2,346.35 |
| Rent of real estate | 27,098.25 | 6,016.03 |
| Advertising | 54,669.06 | 20,510.85 |
| Interest on deposits | 4,415.25 | 4,415.25 |
| U. S. mail cars | 5,828.95 | 5,828 95 |
| Miscellaneous income | 643.82 | *277.85 |
| Total | $7,746,170.77 | $922,291.68 |

*Operating Expenses.*

| | | |
|---|---|---|
| For general expenses | $ 594,017.42 | $175,143.26 |
| Maintenance of track | 692,050.81 | 155,873.68 |
| Maintenance of buildings | 50,988.53 | 9,102.43 |
| Maintenance of cars and vehicles | 623,449.96 | 214,748.78 |
| Maintenance of horse equipment | 119,719.68 | *10,506.06 |
| Maintenance of electric equipment | 470,005.36 | 113,171.90 |
| Road and snow expense | 144,791.73 | *19,667.21 |
| Transportation expenses | 2,698,139.70 | 188,123.31 |
| Injuries and damages | 240,000.00 | ..... |
| Total | $5,633,163.19 | $826,080.09 |
| Net earnings | $2,113,007.58 | $96,211.59 |

*Decrease.

The passenger receipts for the year were as follows:

| | | |
|---|---|---|
| From electric cars | $7,334,516.12 = | 96.20 per cent. |
| From horse cars | 289,760.50 = | 3.80 " " |
| Total | $7,624,276.62 = | 100.00 per cent. |

ELECTRIC LINE EQUIPMENT.

| | |
|---|---|
| Miles of track completely equipped with electric overhead system | 248.145 |
| Miles of track partially equipped (underground wiring only) | 6.577 |
| Miles of track partially equipped (poles only) | 1.479 |
| Miles of track partially equipped (underground wiring and poles only) | 1.353 |
| Miles of overhead electric feeder lines | 261.456 |
| Miles of underground electric feeder lines | 23.31 |
| Miles of underground electric return lines | 13.93 |

The West End road is not the only street railway that has made money this year in Massachusetts. The annual reports of the street railways of the state, filed with the railroad commissioners, show increased earnings in every case. Several of the principal ones and the comparative figures follow:

LOWELL, LAWRENCE & HAVERHILL.

| | 1895. | 1894. | Increase. |
|---|---|---|---|
| Gross income | $403,530 | $269,740 | $133,790 |
| Operating expenses | 262,935 | 205,816 | 57,119 |
| Net | 140,595 | 63,924 | 76,671 |
| Charges | 84,081 | 72,423 | 11,658 |
| Surplus | 56,513 | *8,498 | 65,011 |

*Deficit.

WORCESTER CONSOLIDATED.

| | | | |
|---|---|---|---|
| Gross income | $420,498 | $354,999 | $65,499 |
| Operating expenses | 309,787 | 284,214 | 25,573 |
| Net | 110,787 | 70,785 | 40,002 |
| Charges | 51,778 | 45,478 | 6,300 |
| Balance | 58,933 | 25,307 | 33,626 |
| Dividends | 56,000 | 24,500 | 31,500 |
| Surplus | 2,933 | 806 | 2,127 |
| Capital stock | 700,000 | ..... | ..... |
| Funded debt | 650,000 | ..... | ..... |

LOWELL & SUBURBAN.

| | | | |
|---|---|---|---|
| Gross income | $329,806 | $277,029 | $52,777 |
| Operating expenses | 199,346 | 182,334 | 17,012 |
| Net | 130,460 | 94,695 | 35,765 |
| Charges | 66,534 | 63,699 | 2,835 |
| Balance | 63,925 | 30,996 | 32,929 |
| Dividend | 33,000 | 24,000 | 9,000 |
| Surplus | 30,925 | 6,996 | 23,929 |
| Stock | 600,000 | ..... | ..... |
| Funded debt | 1,000,000 | ..... | ..... |

SPRINGFIELD.

| | | | |
|---|---|---|---|
| Gross income | $ 442,006 | $373,902 | $ 68,104 |
| Operating expenses | 277,155 | 252,269 | 24,886 |
| Net | 164,850 | 121,633 | 43,217 |
| Charges | 30,637 | 18,210 | 12,427 |
| Balance | 134,213 | 103,423 | 30,790 |
| Dividend (8 per cent.) | 80,000 | 80,000 | ..... |
| Surplus | 54,213 | 23,423 | 30,790 |
| Capital stock | 1,000,000 | ..... | ..... |
| Funded debt | 300,000 | ..... | ..... |

BROCKTON.

| | | | |
|---|---|---|---|
| Gross | $ 266,892 | $214,370 | $ 52,522 |
| Expenses | 154,949 | 133,326 | 21,623 |
| Net | 111,942 | 81,044 | 30,898 |
| Charges | 51,374 | 77,313 | *25,939 |
| Balance | 60,567 | 3,731 | 56,836 |
| Dividend (6 per cent.) | 26,130 | 15,000 | 11,130 |
| Surplus | 34,437 | def. 11,270 | 45,707 |
| Capital stock | 596,000 | ..... | ..... |
| Funded debt | 750,000 | ..... | ..... |

LYNN & BOSTON.

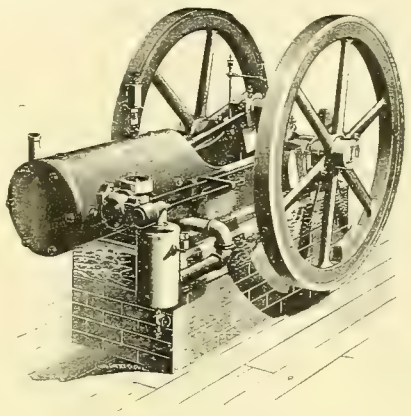
| | | | |
|---|---|---|---|
| Gross | $1,376,977 | $1,238,409 | $138,568 |
| Expenses | 784,392 | 746,303 | 38,089 |
| Net | 592,585 | 492,106 | 100,479 |
| Charges | 499,251 | 404,325 | 94,926 |
| Balance | 93,334 | 87,780 | 5,554 |
| Dividend (8 per cent.) | 80,000 | 80,000 | ..... |
| Surplus | 13,334 | 7,780 | 5,544 |
| Capital stock | 1,000,000 | ..... | ..... |
| Funded debt | 5,379,000 | ..... | ..... |

*Decrease.

The new electric light and power company organized in Boulder, Colo., will take water out of Boulder creek and from there by pipe line to Cochran's mill in Eagle Rock district, where a power plant will be placed to furnish power and light for the working of mines in that vicinity. Between the falls and Boulder four of these power plants are to be established, and all of them are to be run by water conducted in pipes. At the mouth of Boulder canyon a large plant is to be established, which will furnish lights for the city and power for manufacturing purposes.

## Weber Gas Engine.

The gas and gasoline engine shown in the cut is made by the Weber Gas & Gasoline Engine company of Kansas City, Mo. It is a simple and compact machine, with two balance wheels. Poppet valves of the direct-acting type are used and are placed in such a manner as to render them easy of access. The valve gear and governor (including all working parts of the engine, excepting crank shaft, piston, etc.) are encased in an iron housing, dust and grit-proof and run constantly in oil, thereby insuring complete lubrication at all times and reducing the wear to a minimum. The flywheels are exceptionally heavy, giving regularity of speed by their momentum. The governor



WEBER GAS ENGINE.

is sensitive to a slight variation of speed and admits the charges of gasoline and air accordingly. Generally, the incandescent tube igniter with Bunsen burner is used, but engines are fitted with electric igniters when desired. The pistons are of extraordinary length, which give large wearing surface and adds to the life of the engine. The rings used are patented. Instead of ordinary snap rings they are made up in sections with a German silver spring behind each section, forcing the rings out of the walls of the cylinder, at all times taking up the wear, however slight. By this means the rings can be used indefinitely, or until they are worn out entirely. With the ordinary snap rings, as soon as they are worn so far as the ring springs outward they are useless and must be replaced by a new set. The wearing parts are made of the best materials suited to their use and by means of skilled mechanics, high-class machine tools, special machinery, standard templates, dies and jigs, these parts are made interchangeable and are kept continuously on hand at the works, so that if by accident or wear a renewal of any part becomes necessary, it can be supplied promptly.

In the Weber engine the gasoline is used in its natural state with no intermediate gas-making machinery or appliances. The gasoline is kept in a galvanized iron tank, which is usually placed outside the building and connection made from the tank direct to the engine by one-fourth inch or three-eighths inch iron pipe. Thus the gasoline is closely imprisoned between solid iron walls from the time it is put into the tank until its product is exhausted into space through the escape pipe from the cylinder where the gasoline has been consumed. Should the engine accidentally become stopped, no matter from what cause, and the valves left open, not a particle of gasoline would escape, owing to the peculiar and ingenious construction of the gasoline inlet.

## Medbery Specialties.

Among the seasonable specialties offered by the Fiberite company of Mechanicville, N. Y., is a sleet-cutting trolley

MEDBERY SPECIALTIES.

wheel. The electric railway companies generally find it to their advantage to have on hand a few of these useful devices, and those manufactured by the above company are giving entire satisfaction. Its points of excellence are readily apparent from the illustration shown.

The "pony" switch manufactured by the same company, shown in the cut, is having a well deserved sale by reason of the excellence of both material and workmanship. It has been the general impression that almost anything would answer the purpose for a 15 ampere switch. The Medbery pony switch is made in the same manner and with the same regard to accuracy as those for 100 amperes and upward. This has resulted in a demand which would tax the company to meet did it not have unusual facilities for manufacturing. The fact that these switches bear the name of "Medbery" is a guarantee of superiority appreciated by the trade generally.

## Electricity in Paris and in Berlin.

At the meeting of the International Society of Electrician of Paris, held on November 6th, the following table of electrical energy in service in Paris at that date was read:

| Companies. | Total k. w. at dynamos. In service. | Total k. w. at dynamos. In course of construction. | No. of lamps in service 10 c. p. | Total power in kilowatts. | Electric Motors. No. | Electric Motors. Pow'r |
|---|---|---|---|---|---|---|
| Edison Cont'ntal Co. | 2,400 | 680 | 88,000 | 3,080 | 30 | 36.8 |
| Light and Power Co. | 2,025 | 500 | 70,000 | 2,450 | 35 | 90 0 |
| Clichy District Co. | 2,470 | ..... | 65,000 | 3,500 | 67 | 176.6 |
| Parisienne Co. | 2,200 | 2,400 | 80,000 | 2,800 | 15 | 25 7 |
| Champs Elysées District Co. | 1,200 | 400 | 80,000 | 2,800 | ..... | ..... |
| Municipal Station. | 570 | ..... | 41,567 | 1,455 | 7 | 2 0 |
| Left Bank Dist. Co. | 100 | 4,000 | ..... | ..... | ..... | ..... |
| Total | 10,965 | 7,980 | 454,567 | 16,085 | 154 | 331 8 |

Berlin, as against the above, is far and away in advance, as witness the following which bears date of June 30, 1895:

| Kind of Service. | No. of Motors. | Horse power. |
|---|---|---|
| Printing presses | 146 | 546 |
| Elevators | 139 | 834 |
| Ventilating fans | 135 | 180 |
| Metal working establishments | 55 | 196 |
| In the stock yards and slaughtering | 23 | 92 |
| Grinding and polishing | 21 | 100 |
| Woodworking machinery | 17 | 70 |
| Paper-working machinery | 14 | 41 |
| Cloth cutters | 10 | 9 |
| Galvanoplastic work | 6 | 15 |
| Hat and cap factories | 6 | 7 |
| Sewing machines | 6 | 2 |
| Winding machinery | 5 | 5 |
| Leather work | 4 | 25 |
| Washing and drying machinery | 3 | 14 |
| Sundries | 71 | 229 |
| Total | 663 | 2,365 |

## Inspection of Electrical Wires in St. Paul.

W. H. Merrill, Jr., inspector for the Underwriters' Electrical Bureau of Chicago, recently visited St. Paul, Minn., to examine into the general conditions regarding the installation of electric wires in that city. He reports that the overhead wiring is very bad, and asserts that crosses and burn-outs th's winter of all kinds of wires should be an almost daily occurrence. The city has never had control of the installation of electrical apparatus, although an ordinance was introduced some time ago, which was never acted upon. It was found to be defective in many particulars, and a new ordinance was drawn up to meet all the requirements of the situation, which is understood to have the support of a majority of the fire commissioners. As a new department cannot be created by the city without legislative sanction, it has been decided to establish the branch under the supervision of the chief of the fire department, who is heartily in sympathy with the movement, and by a system of fees make the office self-supporting. Companies are in favor of the movement and are instructing their agents to lend their aid and support in its behalf. J. B. Wood, well known to St. Paul insurance men, has been prominently spoken of for the position.

## Death of Thomas McCoubray.

The electrical fraternity will be distressed to learn of the death of Thomas McCoubray, which occurred on December 5th. Mr. McCoubray was widely known in electrical circles and highly esteemed. He was of Scotch-Irish descent and was born in the District of Columbia, May 20, 1847. He was raised in Baltimore and was a graduate of the Baltimore City College. He became a prominent Mason, reaching the 33d degree, and holding office in each of the bodies through which he passed. He was five times elected master of St. John's Lodge and was eminent commander of the Baltimore Commandery of Knights Templar, secretary of the Board of Relief and prominent in other branches of the order. He opened the New York office of the Baxter Motor company and was actively associated with Frank Morrison in that company. At one time he was secretary of the National Electric Light association, and he was also, for a time, connected with the Okonite company. Of late he had devoted himself to the telephone field, where he was conspicuous. He invented and exploited the auto-telephone system of the Tucker Electrical Construction company, recently described in the columns of this journal. This proved successful, and Mr. McCoubray was beginning to reap the reward of his labors at the time of his untimely death.

## Chicago's New Down-town Trolley Line.

The Clark street electric line of the Chicago City Railway company, which runs from Seventy-ninth street down town to the City Hall, is in operation. The service is subject to many delays, but it is claimed that one car with a trailer made the trip in 48 minutes.

The cars on this line encounter a number of railroad grade crossings, all of which prove a serious annoyance. At Auburn Park the Rock Island track must be crossed; also at Sixty-fifth street; then the Fort Wayne, the Stock Yards line, and finally the Sixteenth street crossing of the St. Charles Air Line, the Wabash freight tracks, the Western Indiana, and where the Erie road does its freight-house switching. This last crossing is 325 feet in length and a network of tracks. Trains occupy the crossing at all hours of the day. It is only guarded now by flagmen, and the ordinary street gates are operated from a tower. It is reported that the street railway company has made a proposition to the railroad companies using this crossing to bear with them the expense of placing automatic gates there which will close whenever a train approaches and not raise until after it has passed. The gates would be closed by electricity whenever any train was within 300 feet of the crossing. A car could then not get on the tracks without first destroying the gates.

Mayor Swift received a check for $25,000 from the City Railway company, in accordance with the terms of the bargain made before his honor consented to sign the ordinance allowing an extension of the trolley system to Washington street.

## Washington View of Sawyer.

In his Washington dispatches to the *Chicago Record* W. E. Curtis gives the following sketch of a former prominent figure in the electrical world:

W. E. Sawyer, who was alleged to have made the [incandescent lamp] discovery before Edison, was a versatile but unprincipled genius and is well remembered in Washington. He was at one time employed by Gen. B. F. Butler as a stenographer; again he was correspondent of the *Boston Traveler* and off and on worked at a telegraph key in the Western Union office in this city. He was expelled from the reporters' gallery for listening to the dispatches of his fellow correspondents when they were being sent over the wire and stealing the news they contained, and Uncle Isaac Bassett, the venerable doorkeeper of the United States Senate, once dragged him out of the attic of the Senate chamber, where he was trying to overhear the proceedings of an executive session. He was a short, thickset, bandy-legged fellow, always seedy, ill-dressed and of a very nervous and excitable temperament. He had the inventive genius but it was poorly developed, and his natural depravity led him to adopt and develop the ideas of others rather than his own. He invented what is known as auto-telegraphy—that is, the process of sending fac-similes of handwriting or drawings by wire, and sold the process to Capt. Howgate of the United States Signal service for $20,000. With this money he went to New York, set up a laboratory and advertised himself as an electrical engineer. He was intimate with Edison, and is supposed to have obtained an inkling of his experiments in using electricity for lighting purposes, for he appeared in Washton about the same time with an application for a patent for such a purpose.

Man was the capitalist who furnished him money. As Sawyer was a spendthrift and a drunkard he never enjoyed any advantage from his fraud and went from bad to worse until he shot a man in something like a panel game one night. For this he was tried and sentenced to imprisonment, but before they could take him to the penitentiary he committed suicide in his cell.

## Electricity on the Canals.

Next season's opening of the state canals will doubtless find at least 12 miles of the electric cable system, beginning at Buffalo, ready for operation; and inasmuch as there is no reason to suppose that the calculations of the engineers employed on the work are wrong, says the *Brooklyn Citizen*, we may expect to see the system extended as promptly as possible to the whole system. It is expected that the boats will be able to make twice the speed they now make by mule power and at about a quarter of the cost. The new system will put an end to the use of the mule on the towpath at all events, and even if no employment be found for him elsewhere because of the adoption of electric power, it is not likely that the mule will kick. The fact is, however, that if the canals had been of the proper depth the mule would have given way to steam power for the movement of boats long ago. Because of their shallowness chiefly even the propeller could not be employed. But with the deepening of the ditches, as proposed by the bill to authorize the expenditure of $9,000,000, the canals will come into greater use, and before long that will lead to the further consideration of the movement to so widen and deepen them that cargoes may be brought from Minnesota and all the Northwest in ships that can carry them to their ultimate destination across the sea.

## Electric Railroading in the Alps.

The methods to be pursued in the construction of an electric railway up the Jungfrau have recently been the subject of special study by a scientific commission. Trigonometric and phogrammatic surveys are to be made from the lower station at the Eiger glacier to the summit. Two routes, says a foreign exchange, are proposed from the Scheideggs to the Eiger glacier, and the one selected is to be laid out at once, so that the work of construction may commence in the spring. Prizes amounting to 20,000 francs will be offered for the best designs for electrical apparatus in the superstructure and the rolling stock. The aggregate water power available is estimated at 7,000 to 8,000 horse power. The distance from the first primary station to the lower end of the road will be about 3¾ miles, and this section will be built as quickly as possible. On further extension of the tunnel construction, a second primary station will be established three to 3½ miles farther on. The whole line will be 7⅝ miles long, and for working it the two primary stations are to be connected. It is intended to limit the speed to 5½ miles per hour on grades of 792 feet per mile or less, and to 4½ miles on steeper grades. The steepest is to be 1 in 4, or 1,320 feet per mile. The gauge is one meter; the sharpest curve of 327 feet radius. The tunnel, which will begin at the Eiger glacier, will be 10 feet six inches wide and 13 feet high.

## Direct-connected Gas Engines in Belgium.

The services rendered by the gas engine to electric lighting have been extensive and manifold. This engine has not only been used alone, both in public and private plants, but a useful field has been found for it as an adjunct to steam stations, says the *Electrician* of London. Usually the supplementary gas engine plant is to be found along with the steam engines in the same station; but at Brussels this practice has been modified in an interesting manner, by putting the auxiliary gas plant in a separate sub-station situated at some distance from the main station. The site chosen is a large vault beneath the Belgian State Railway offices; and here the India Rubber and Telegraph Works company of Silvertown has recently installed two out of a total of five generating sets, which it is intended ultimately to provide. Each set comprises a 120 horse power twin cylinder gas engine, working on the "Otto" cycle, direct-coupled through Raffard clutches to two dynamos, one at each end of the crank shaft. The set runs at 150 revolutions per minute, and at this speed the dynamo gives a normal output of 320 amperes at 125 volts. The sub-station is provided with a storage battery of Julien cells, having a normal capacity of 250 amperes at 250 volts for eight hours' discharge. One of the features of especial interest in this sub-station is the direct-coupling of the gas engines. Such engines have long been adopted in various stations on the continent; but until recently they had not made their appearance in this country. Indeed, we have heard it stated more than once that the flexible belt between a gas engine and a dynamo is necessary to steady running of the latter. No such necessity appears to have been recognized in the successful stations of the Continental Gas association, nor at Brussels; and we were glad to hear the other day that the additional plant for the Belfast gas power electric supply station is to consist of direct-coupled engines and dynamos.

## Chicago City Railway Finances.

The Chicago City Railway has in contemplation the building of 40 miles of new single track electric road, or 20 miles of double track. Judging by past experiences the cost of this road will be $7,500 a mile for single track, or for the entire 40 miles there will need to be expended in the neighborhood of $300,000. The company is not in a position where it will need to go into the market for this money. It has no floating debt at the present time, but, instead, has a surplus. There was issued in July of the present year $1,000,000 in stock, which was sold at par to stockholders, and the proceeds of this sale have paid for all the extensions that had been made up to the time of the stock issue. The road is earning 18 per cent. a year upon its capitalization of $10,000,000, or $1,800,000 a year. It pays annual dividends of 12 per cent. upon its capital, or a total of $1,200,000, leaving a surplus of $600,000 a year. This surplus will be sufficient to pay for all the electrical extensions that are in contemplation. It is not probable, therefore, that any of the money to be derived from the sale of the $2,000,000 of new stock, which the board has asked the authority to issue, will be used for any extensions that are in prospect. It is believed by those who are familiar with the situation that the stock issue is intended to be used toward the retirement of the present outstanding issue of bonds, which amounts to $4,619,500. There is no other need apparent to which the $2,000,000 could be put.

President Wheeler said yesterdayit was not determined how this money was to be expended. He said there was a considerable amount of new electric line to be built, and that money would be needed for this. He did not deny that the bonds of the company might be retired in part. He did deny, however, that there was any truth in the report that he would retire from the presidency of the company at the end of the present year.—*Chicago Tribune.*

Prophetstown, Ill., has contracted to build and operate an electric light system for a term of 20 years.

The project of a direct electric road from Cohoes, N. Y., to Albany is now said to be an assured success.

The report of Albert F. Schock, receiver of the Ottawa, Ill., Electric Street Railway company, was filed in the Federal court on December 6th concerning the sale of the property under the foreclosure of the Mercantile Trust company's $75,000 mortgage. He recommended the acceptance of the $7,500 bid of the General Electric company.

## Lombard Hydraulic Brake.

A new hydraulic brake for use on electric cars is shown by the illustrations. Fig. 1 shows the box, which is about 30 inches long, 12 inches wide and eight inches deep, containing the piston and pump cylinders connected with the pressure tank, which is about 38 inches long and six inches in diameter, the whole apparatus weighing about 150 pounds. The box may be placed anywhere under the car floor where the sprocket wheel can be connected with the axle to get power to drive the pump. The tank may be placed anywhere that can be reached by piping to connect both sides of it to box containing the brake and pump cylinders,

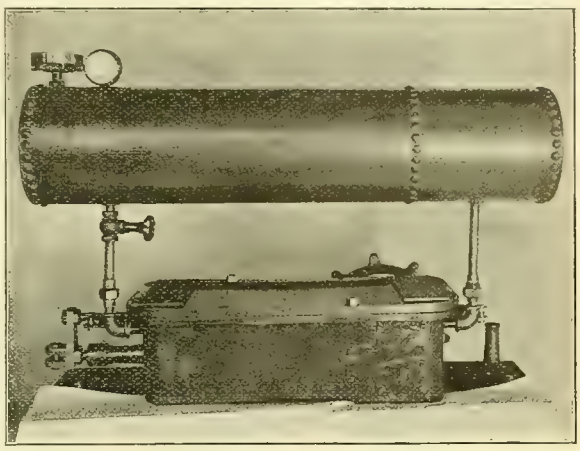


FIG. 1. LOMBARD HYDRAULIC BRAKE.

preferably under the seats of the car. This tank is partitioned into two chambers; the larger chamber is filled two-thirds full of oil and is charged with air compressed to about 220 pounds pressure. The smaller chamber is practically a vacuum. A safety valve is placed on the pressure end of the tank. The pressure gauge may be place anywhere on the car.

In Fig. 2 is shown the brake cylinder and pump arrangement of the valve operating mechanism. It will be observed that the shaft, having a small crank at one part of it driven by the sprocket wheel and chain from the axle, is connected to the piston rod of the pump by means of a fork connecting rod, giving a reciprocating motion to the piston. The piston and valves are so arranged as to make it a single acting pump. The brake operating piston, the larger of the two having a rod projecting outside of the casing, is so arranged as to receive the brake chain coupling. Any movement of the piston will operate the brake lever and so set the brakes of the car. It is also connected with the valve by a rod. This piston and rod may travel 10 inches, and is 2½ inches in diameter, taking 18.84 cubic inches of oil, or about one pint, to fully extend the brake rod. Another rod operates the three-way valve which controls the setting or releasing of the brake, and is operated by a handle at either end of the car. Pipe connections make a closed circuit for the fluid to pass from the pressure tank through the brake piston, setting the brake and exhausting into the vacuum, then being pumped back into the pressure tank by a few strokes of the pump through channels in the pump castings and pipe, thus continually maintaining the

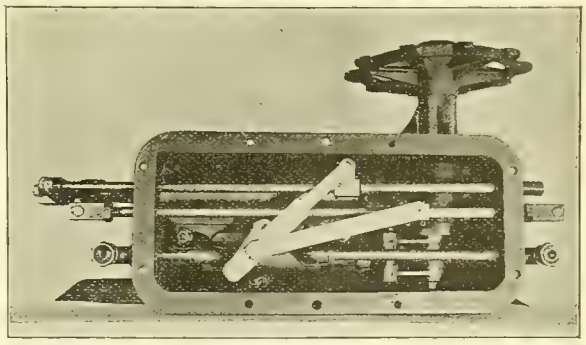


FIG. 2. LOMBARD HYDRAULIC BRAKE.

pressure and vacuum, the piping being so arranged that oil, and never air, enters the brake cylinder. The iron casting is partly filled with lubricating oil and closed tightly, thus continually lubricating all parts needing it.

The power stored in this pressure tank consists of an elastic air cushion of 220 pounds pressure and an inelastic fluid, which in this case is preferably oil. In operation this fluid is used as a medium to transmit the stored energy of the air pressure from the tank to the brake operating piston. Any movement of this piston will operate the brake lever and set the brakes of the car. To operate this brake piston the pipe running from the three-way valve sup

plies the fluid under pressure to move the piston, all in accordance with the opening of the three-way valve, which may be set at will by the operator. A compensating lever mechanism, shown in Fig. 2, will set the fluid valve so that the large piston can be held at any position or part of its stroke; that is to say, the piston can be moved forward to put the stroke on light or heavy or at any point desired and hold it there. The same three-way valve also regulates the release in the same way and controls the throwing off of the brake shoes, so that the brake can be held at any grade of tightness desired and is under the entire control of the operator. As before stated, the oil is merely a medium of transmitting the power from the pressure tank to the operating brake piston and from the force pump back to the pressure tank to restore the energy consumed. In this case the pump shaft only has to make four or five revolutions to return to the pressure tank all the oil used in its operation.

The discharge of this hydraulic brake is also worthy of consideration. It is entirely noiseless; in fact, discharging into the vacuum tank, the exhaust or discharge of the brake is instantaneous, although under full control of the operator, as the least movement of the handle changes the valve and the direction of the movement of the oil.

The use of oil, an inelastic fluid, for transmitting the power, gives several advantages to this brake not possessed by any other braking device: First, ease of maintaining the pressure; the compressed air does not leak out. Second, the simplicity of its operation; any man who knows enough to operate the hand brake will control the car better with this brake on his first trip than he can with the old brake, because the least movement of his handle is instantly answered by the quantity of oil behind the brake piston, and consequently the amount of pressure of the shoes on the wheels. In going down grade he can ease off a less amount of pressure than by any other brake, controlling his speed absolutely. In making a start on an up grade the same facility enables him to hold the car at just the point at which the wheels would begin to revolve; then applying the power the easy release of the brake allows the starting without a hitch or jerk. He can make the ordinary stops in about one-half the time or distance that he can by his hand brake, and make his trip in 10 per cent. better time. The same facility to ease off his brake a little and still hold, if he sets it harder than necessary, prevents the skidding of the wheels. For an emergency stop his natural way is, as in ordinary stops, simply to pull the handle, opening the three-way valve and the whole force is instantly applied and stays on, even if the motorman jumps. The controlling rod is so placed that a collision would tend to open the valves and set the brakes. Emergency stops have been made in six feet.

This brake is manufactured by the Lombard Water Wheel Governor company, 61 Hampshire street, Boston.

## British Telegraph Service Losing Money.

The latest report of the postmaster-general of England shows that the annual deficit of the telegraph service goes from bad to worse. In seven years the loss amounts to nearly $13,000,000, and this, in spite of, or perhaps because of, a good increase in the business done. To put it bluntly the English telegraphs are bankrupt and are only kept up by heavy drains on the national purse. There are now 9,661 telegraph offices in the United Kingdom, and the number of messages has reached 71,589,064 per year, or an average per head of population somewhat larger than our own, though by no means evincing the rapid acceleration seen in the use of the telephone. In this country there are now 10 times as many telephone conversations exchanged as there are telegrams sent each year; but in all England there are only 60,000 exchange telephones, so that the telephone has not yet begun to act as a serious check on telegraphic expansion and revenue. Yet it is already noticed in London that the more general use of the telephone has kept down the increase in the number of telegrams to about 250,000. A very interesting feature of the English work is that during the year 19 additional shore lighthouses and light stations have been connected with the network, while cables have been laid to two lightships and one lighthouse rock.

The Leijkam-Josefthal (Austria) paper mill, which was destroyed last spring during an earthquake, has now been rebuilt, and extensive use has been made of electricity in the fitting up of the mill. The water power of a river some two miles distant has been employed, and a generating plant of 500 horse power has been erected. This plant consists of two turbines of 250 horse power each, driving on to a common countershaft, to the two ends of which two "drehstrom" generators of 250 horse power each are coupled. These machines are of the Ganz type, and give an electromotive force of 3,000 volts when running at 170 revolutions per minute. The current is taken to the mill by three overhead conductors, where it is transformed to 300 volts. The loss in the conductors is about 5½ per cent. At the mill a third generator of 250 horse power of the same type has been provided, but working at only a potential of 300 volts. This machine will be used as a supplementary one. From a main switchboard the "drehstrom" is distributed to various motors which drive the mill shaftings and the special machinery. There are motors of a capacity ranging from 160 horse power to three horse power. A continuous current dynamo for lighting purposes is driven off the main shaft.

# CORRESPONDENCE.

## New York Notes.

NEW YORK, December 7.—Some interesting testimony was offered yesterday at the Hotel Metropole before the Assembly committee appointed to inquire into the physical and fiscal condition of the street railways of this city. Secretary L. L. Delafield of the Board of Rapid Transit Commissioners, in answer to the question, "How much money have the commissioners expended since 1894?" replied: "The total amount appropriated is $61,775.86, and we have expended of that between $56,000 and $59,000—the exact figures I have not with me." Commissioner John H. Inman was asked:

"Do you favor municipal ownership at all, unless in a large enterprise like this, which private capital will not undertake? Do you favor the municipality operating a railway?"

"No, sir; I do not. I would sublet it to a private company."

Mr. Inman stated that as a general principle he did not favor state ownership, but he thought the present Rapid Transit act was all right. He also stated that the Board of Rapid Transit Commissioners was ready to give reasonable concessions to the elevated railway for the purpose of securing rapid transit if proper application was made.

Mr. Steinway, another of the Rapid Transit commissioners, was called. Mr. Steinway said that he thought that the building of an underground road was the best thing that the city could do for its interests.

"The underground railway," said he, "will not cost $50,000,000 to build, and in 40 years the city will own it completely, without paying a cent. It will be the best thing the city ever did."

"Do you believe in municipal ownership in general?"

"No, sir; I am opposed to municipal ownership in general because I believe it would build up a corrupt political machine and be the refuge of political hacks."

Mr. Steinway said he was opposed to the city operating railways. He also said that the new underground railway in London was a great success, with only one drawback, that the elevators carrying passengers down to the road 95 feet under ground were not adequate to the demand. The use of electricity would remove all the unpleasant features of underground travel.

Mr. Steinway then corroborated Mr. Inman's statement that the board stands ready to listen to any propositions the elevated road may submit.

William Barclay Parsons, chief engineer to the commission, next took the stand. He submitted some of his reports, and said that the building of an underground railway was perfectly feasible from an engineering point of view.

"There is no great engineering difficulty," said he, "in the building of the road, but there is a vast amount of detail. The cable road will not be interrupted for a moment."

Chairman Nixon announced that the committee had finished its labors in New York, and an adjournment was taken to meet at Albany on Monday morning.

Judge Lacombe, in the United States Circuit Court, has handed down a decision perpetually enjoining the Bryan-Marsh company from manufacturing any incandescent electric lamps made in accordance with or embodying any of the inventions claimed under letters patent issued on June 14, 1881, to Thomas A. Edison, and now the property of the Edison Electric Light company and Edison General Electric company.

There were filed at Albany and with the county clerk yesterday the largest application for railroad franchises ever made in Kings county. The applicants are the Brooklyn City Railroad company, its lessee, the Brooklyn Heights company, and the Brooklyn City & Newtown Railroad company. The application asks for 200 miles of Brooklyn streets for the building of street railroads. It will be formally presented to the Board of Aldermen on Monday. It includes the recent Flynn syndicate application and 140 miles of additional streets, reaching from the bay to the Queens county line. If the Heights people should get these extensions, they would double their mileage and become probably the largest surface railroad company in the world.

Charles F. Franklin, chief trolley inspector of Brooklyn, reports to Mayor Schieren that there were 105 trolley ordinance violations last month. The highest speed noted was on Nostrand avenue, and was at the rate of 25 miles an hour. "I would state," Mr. Franklin says, "that the running time on the various lines has been reduced, thus increasing the speed, and consequently the number of accidents, which now number two daily."

The National Electrical Exposition company has been incorporated for the purpose of holding an electrical exhibition here in May next in connection with the nineteenth convention of the National Electric Light association. The officers of this company are Harrison J. Smith, superintendent of the Edison Illuminating company of New York, president; Wm. F. Weiss, vice-president of the New York Steam company, vice-president; George F. Porter, secretary and treasurer. The executive committee, which is the governing power of the company, is composed of H. J. Smith, C. O. Baker, Jr., R. B. Corey, H. L. Lufkin and E. F. Peck. The board of directors consists of H. J. Smith, C. O. Baker, Jr., John A. Seely, R. B. Corey, W. A. Stadelman, H. H. Harrison, H. L. Lufkin, W. F. Weiss, J. W. Godfrey and E. F. Peck. The stock has all been subscribed and 10 per cent. of the capital paid into the hands of the treasurer. The New York Industrial building has been secured for the exhibition hall. This building occupies the block bounded by Forty-third and Forty-fourth streets, Lexington avenue and Depew place. The building was constructed expressly for trade exhibitions. It has seven stories with roof garden, is lighted by a plant of 5,000 incandescent lights capacity and has a spare steam plant of 300 horse power. The lighting companies of New York can also supply direct or alternating current to any amount desired, and two gas companies can furnish gas through two four-inch mains. The company is now prepared to receive applications for space. All communications should be addressed to the executive office of the company, 136 Liberty street, New York. W. F. O.

## Buffalo and Niagara Falls.

BUFFALO, December 7.—The Board of Aldermen has unanimously decided to grant a franchise to the new electric street railway company, of which Tom L. Johnson is the guiding spirit. If the councilmen do not agree with the Board of Aldermen, and alter the franchise, the document will go back to the Board of Aldermen in its amended form. It will then travel between the council and the Board of Aldermen until the two bodies agree. Then the franchise will be forwarded to the mayor for his approval. If he signs it the Buffalo Traction company will have secured the prize. The Common Council will consider the matter at a public hearing on December 21st at 10 A. M.

The Niagara Falls and Buffalo trolley line is being operated by Niagara Falls power to the city line of Buffalo, the power house at Tonawanda having been closed for a time.

Gen. John C. Graves, president of the Citizens' association, says in relation to the distribution of the power from Niagara Falls in Buffalo: "I feel sure that the settlement of this vexed question of a power franchise will have an immediate and all-round good effect. It will bring money to Buffalo, it will bring business here, it will bring manufacturers and thousands of other people here. The power will be much cheaper than the average, and this will be especially true to small consumers—those whose business requires say no more than 50 or 75 horse power. Its effect on the outside world and on business at home I think will be observed immediately." F. C. P.

## Northwestern Notations.

MINNEAPOLIS, December 7.—F. H. Osgood, A. L. Hawley and J. T. Robinson propose to put in an electric light plant for Seattle, Wash., and sell it to the city on the installment plan, in 36 monthly installments of $1,833 each, the plant to cost $66,000. They propose to bury their wires, and to avoid tearing up the streets will run their conduits in the alleys.

The Plainview, Minn., local paper suggests putting in an electric light plant in connection with the waterworks.

The city of Mankato, Minn., has made an agreement with the Mankato Gas & Electric company, by which that company will furnish light for an indefinite length of time at $2 per month per light for incandescent and $8 for arc, and the street lights have been turned on again.

The Edison Light & Power company will string 14 miles of wire on the north side of La Crosse, Wis., to furnish light for private parties.

New equipment is being placed in the electric light plant at Grand Rapids, Minn.

Electrician Sam Sullivan got lost in the loft of the Hotel Spaulding, Duluth, while examining the electric wires. His candle blew out, and having no matches he could not find the exit. For three hours he crawled about the loft, which is 50 by 100 feet, before he found the trap-door.

It is understood that work will soon be begun on the Oshkosh line of the Central Wisconsin Electric Railway company.

The National Electric company of Eau Claire, Wis., secured the contract for enlarging the Rochester, Minn., electric light plant.

The various telephone and telegraph companies at Winona, Minn., have been notified to paint their poles, a separate color being given each company to distinguish the poles.

Louis Wade of the Edison works at La Crosse, Wis., had three fingers split at the ends by coming in contact with a live wire.

The city council of Des Moines, Ia., is considering an underground wire ordinance.

It is announced that all contracts have been let for the construction of 15 miles of electric street railway in Oskosh, Wis., and 26 miles of suburban line to Kaukauna, for the Central Wisconsin Electric Railway company. The con-

struction contract aggregates $350,000, and the steam plants, cars and electrical apparatus $155,000 more. It is to be completed June 15, 1896.

General Manager H. R. Warren of the Duluth Street Railway company, was arrested and charged with violating the state law requiring all street cars to be vestibuled between November 1st and May 1st. During the trial it developed that the law is defective and that it does not provide any penalty in the event of the fine not being paid. The jury disagreed.

Business men of Trempealeau, Wis., will endeavor to secure an appropriation from the next legislature to have the Trempealeau river improved so as to be navigable for canal boats and smaller craft. With that secured they will then fit out a trolley electric system to operate the canal boats, and will furnish light and power to the cities along the river.

It is announced that the Twin City Rapid Transit company will build a second interurban electric line between Minneapolis and St. Paul, which will relieve the congested condition of the present line and will afford the people of St. Anthony Park the connection with Minneapolis which they have so long demanded. The line will be a continuation of the Como avenue line in Minneapolis, running via the county road to St. Anthony Park, past the state fair grounds, through Warrendale, to Como Park, and via Rice street into St. Paul. It is estimated that to relay that part of the line already built, grade the rest and construct it with 80-pound steel will cost $87,000. A bonus of $35 000 is asked, and those interested have offered $25,000. It is probable they will get together on the amount and it will be built. It is promised to be in operation by June 1st, if the proposition is accepted.

Walsh Bros. of Clinton, Ia., are applicants for a franchise at Davenport, Ia., for an electric light, gas and steam heating plant. They propose to form a company with $300,000 capital stock.

The city of Davenport, Ia., is taking bids until December 31st for a five-year contract to light the city.

Waubay, S. D., is to have an electric light plant.

A right of way is being secured for the La Crosse, Black River Falls & Neillsville Electric railway. The estimated cost of the line from La Crosse to Black River Falls is $300,000. of which $289,000 has been subscribed.

The Parkview Mining company of Crevasse, Mont., is considering putting in an electric light plant in the spring.

The electric light plant at Chariton, Ia., has broken down for the third time, owing to its boiler being worn out.

The Dubuque, Ia., city council committee on electricity recommends the appointment of a city electrician.

Malicious persons tore down several miles of wire of the Postal Telegraph company and the telephone exchange at Webster City, Ia. A reward of $100 was offered to apprehend the miscreants.

The Eastern Coal & Coke company of Belt, Mont., will put in an electric light plant this winter or in the spring.

The electric light company at Beatrice, Neb., will shut off the street lights unless the city will increase the amount paid materially. The council offered to pay the same amount for a midnight service that it has been paying for all-night service, but the company will not accept it.

The council of Oshkosh, Wis., has made an informal statement that the Central Wisconsin Electric Railway company must have seven miles of road laid by January 1st to secure an extension of the franchise.

M.

## PERSONAL.

Francis R. Upton, general manager of the lamp department of the General Electric company, has severed his connection with that company to accept a responsible position in the general manager's office of the National Tube Works of McKeesport, Pa. Mr. Upton is very well known to the electrical fraternity of the entire country, and only good wishes follow him in his new business association.

## ELECTRIC LIGHTING.

Webb City, Mo., is about to award an electric light franchise.

Redwood City, Cal., expects to soon have an incandescent electric light system to cost $30,000.

Unionville, Mo., has decided to erect an electric light plant. Bonds will probably be issued.

The city of Sauk Rapids, Minn., has voted to issue $25,000 worth of bonds to build an electric light plant.

## ELECTRIC RAILWAYS.

It is proposed to organize a company to build an electric railway from Mill Valley to North Amherst, Mass.

A mandamus suit to compel the mayor and the city collector of Chicago to enforce the ordinance of April 1, 1881, in relation to the license fee of street railway companies, was begun on December 4th in the Superior Court. It was filed by Jesse B. Barton, ex-assistant corporation counsel, and the petitioner is Frank J. Coates. The petitioner says the companies own and actually operate cars as follows: The South Chicago Street Railway, 91 cars; Calumet Electric, 106; North Chicago, 747; Chicago City Railway, 1,962; West Chicago Street Railroad, 2,184; North Chicago Electric, 44; Chicago and Jefferson Urban, 33. The court is asked to issue a mandamus writ to compel the city officers to enforce the ordinance as it stands and make the companies pay $5 for every car, which would result in a large increase in the revenues of the city. At present the companies pay according to the number of trips and not according to the number of cars. The case will be heard by Judge Ewing.

## POWER TRANSMISSION.

The incorporation of the Pacific Transmission company of San Francisco marks the beginning of an interesting project for the electrical transmission of power from the mouth of California coal mines. The company will be controlled by the San Francisco & San Joaquin Valley Coal company, whose mines are at Corral Hollow in Alameda county, and is one of several important undertakings connected with that corporation. The new company will have a capital of $3,000,000, divided into 30,000 shares of the par value of $100 each, and will be empowered to build and operate steam and electric plants at the coal mines in Corral Hollow and Alameda county for the purpose of generating electrical power, and furnishing the same by transmission over wires to Oakland by way of Livermore, Haywards, San Leandro and other towns en route, and also to San Jose and to Stockton. It is intended to ultimately extend the service to San Francisco. At least $1,000,000 will be expended in the construction of the plants, and it is said that the General Electric company, which put in the plant at the Folsom dam which furnishes electrical power to Sacramento, and has recently arranged to supply Fresno with similar power from a distance of 35 miles, will have the contracts. The cheapest item connected with the generation of the electrical power will be the fuel, which will consist of the waste and refuse screenings, dust, etc., from the coal produced at the extensive Corral Hollow mines. The supply of this kind of fuel will be almost inexhaustible, and as it is extracted from the mines with the merchantable coal it is all paid for by the latter. As the coal company will control the transmission company there will be no charge for this fuel. The plant at the mines will generate at the start 6,400 horse power, of which about 5,000 horse power will be supplied to San Jose and to Oakland, through the towns en route, and afterward Stockton will be taken in, and if necessary the supply can be increased so as to extend the service even to San Francisco and other more distant points. The company expects to furnish this power to Oakland, San Jose, Stockton and intervening places at $60 per horse power per year. The present cost ranges from $60 to $80, according to conditions.

## MISCELLANEOUS.

A unique electric elevator has recently been built for the Ottawa Canoe Club, Ottawa, Ont. Owing to the great rise of the Ottawa river every spring, the boat house is situated a good height above the water level the greater part of the year. The transfer of the boats from the house to the water, and *vice versa*, was thus extremely difficult, and to obviate these drawbacks there has been erected a framed gangway, with a skeleton car, an ordinary worm-geared hoisting drum, and a three kilowatt 500 volt Edison motor. The motor is belted to a countershaft, which, in turn, is belted to the shaft carrying the worm. The car stops automatically at the top and bottom of the allotted course. Mr. Dion, of the Ottawa Electric company, treasurer of the club, designed the arrangement.

## TRADE NEWS.

The Philadelphia Electrical Equipment company of 816-822 Cherry street, Philadelphia. has been incorporated to do a general line of business in electrical repairing. All work is guaranteed, and the company is prepared to handle all the business that is offered.

The Indiana Rubber & Insulated Wire company, manufacturer of the widely known Paranite wires and cables, announces that it has removed its office from Marion, Ind., to its factory at Jonesboro, Ind. It is believed that the handling of the business will be materially facilitated by this change.

About two years ago the Jewell Belting company of Hartford, Conn., purchased the rights for the manufacture of a cement to be applied to the face of pulleys, to prevent the slipping of belts, especially those used for high speed, and after over a year's trial by a number of the leading electric light and power stations the Jewell people are receiving high endorsements of the success of this cement, accompanied by large orders.

The Eddy Electric Manufacturing company of Windsor, Conn., is endeavoring to keep abreast with the large number of orders which have been placed with this concern, and Secretary Newton reports that it will be necessary to run many departments of the factory over-time in order to fill orders promptly. The apparatus manufactured by the Eddy Electric Manufacturing company is widely known as being standard, and it is gratifying to note the continued success of the company.

The Upton arc lamp for alternating current (made noiseless by means of the new anti-hum device which is applied only to the Upton lamp) is one of the most popular specialties in the long list of the Electric Appliance company, which states that every sample lamp sent out means an additional regular customer of the Upton lamp. The cost of this anti-hum device is comparatively small; its use is said to mark the difference between a satisfactory and an unsatisfactory alternating arc lamp for inside use.

F. M. Bernardin, Kansas City, Mo., dealer in general electric railway supplies, has met with encouraging success in dealing with western buyers. He is agent for a large number of excellent specialties and can furnish anything used in the construction and maintenance of an electric railway. Mr. Bernardin is agent for the Ohio Brass company's supplies and has done a large business in this line in particular. He is able to supply the H. & C. sleet cutting trolley wheel for which many strong claims are made. Mr. Bernardin is an energetic business man and his long experience with electric railways enables him to meet and overcome any difficulty which may arise with dispatch.

Some idea of the diversity of uses to which electric motors are now being put, and the rapid spread of electricity in different directions, may be gathered by glancing at the list of orders for motors received in the power and mining department of the General Electric company during one month last summer: Operating mining machinery, shoe factory, operating a yarn factory, a tannery, a powder mill, a watch factory, iron working machinery, a foundry, hoists for electric cranes, ventilator on a gunboat, propelling electric launches, the operation of elevators, blowing church organs, operating woolen mills. These orders are scattered throughout the following named states and nations: California, Colorado, Indiana, Ohio, Connecticut, Michigan, Pennsylvania, Rhode Island, Wisconsin and New York, Peru and Brazil.

Western Manager C. W. Woodward, of the Chicago office of the Electric Storage Battery company of Philadelphia, has received an order from the Chicago Telephone company to furnish a 43 kilowatt battery for its exchange at Oakland and a four kilowatt battery for its exchange at Pullman. These cells will be used as a central station equipment for the two branch exchanges located at the places mentioned —a service for which the chloride accumulator has been adopted by the Chicago Telephone company. This is only one of the numerous orders received for chloride accumulators for telephone work, showing a growing tendency on the part of telephone companies to utilize storage batteries for their exchanges to the exclusion of other forms of apparatus. Mr. Woodward is much pleased over the increase in western business and states that the orders have been coming in at a rapid rate of late.

The Raymond improved gas engine, built by the J. I. Case Threshing Machine company of Racine, Wis., has attracted wide attention in the West by reason of its great economy, steadiness of operation, fine workmanship and compact, vertical arrangement. It is especially adapted for electric lighting plants, and although but recently placed on the market has met with such success that even the great facilities of the Case company have been taxed to meet the demand. The engines are built in sizes from one to 300 horse power, and with single, double or quadruple cylinders. They are illustrated and described in a fine catalogue which has just been issued by the company, and which will be sent on application. The company claims the greatest economy of gas or gasoline in proportion to power developed, and cites this instance: "One of our 50 horse power (actual) double cylinder engines belted direct to a 50 horse power T. & H. arc dynamo, and producing 52 arc lights over 28 miles of wire, performed the work by actual official test as follows: Figuring one arc light per horse power, 52 horse power was developed on five gallons of 74° gasoline for one hour and 47 minutes, or one-eighteenth of a gallon per horse power per hour."

## BUSINESS.

The Peru, Ind., Electric Manufacturing company's business is increasing rapidly. The factory is now running until half past nine o'clock at night to enable it to keep up with orders.

A. O Schoonmaker, 158 William street, New York, imports India mica, and can furnish this product in any size, shape or pattern, cut for commutator segments, washers, etc., or in any other form desired.

The electrical department of the Chicago General Fixture company, in charge of F. Overbagh, has been extended to occupy the entire third floor of the building at 169 Adams street, as well as the fourth floor, which formerly sufficed.

Dixon's silica graphite paint, manufactured by the Joseph Dixon Crucible company of Jersey City, N. J., will be used in painting all the tin work and skylights of the Post-office Department building at Washington. A quantity will also be used on the capitol and the District government building.

The Clonbrock Steam Boiler company of Brooklyn builds Morrin Climax boilers ranging in capacity from 50 to 1,000 horse power. The company desires to make this clear, as in an advertisement recently printed in the WESTERN ELECTRICIAN a typographical error made it appear that 100 horse power was the maximum.

Charles A. Bramhall, general sales agent in charge of the New York office of the Standard Thermometer company, which manufactures the well-known Upton arc lamp, reports that the factory is rushed with orders and that in his local territory he is more than satisfied with the future outlook for the success of his company's interests. Mr. Bramhall is one of the pioneers in the arc lamp business, a pushing salesman, and has a host of friends who will wish him continued success.

McLeod, Ward & Co. of 27 Thames street, New York, are having a boom in their Kinsman desk light. Orders have come in so rapidly upon them of late that it has taxed their capacity to fill them promptly. The many features of excellence in the Kinsman desk light are noted when it is understood that it serves as a reflector, may be moved to any desired angle, produces a soft light because of two glass cylinders, one of clear glass and the other of ground glass, which can be turned by a knob at the further end. It is always within easy reach of a person sitting

at the desk. These fixtures are fitted with any style of socket and are made in two styles, the only difference being in the style of the stand ornamentation. They have been designed for use on flat desks and tables, and are made handsomely, being nickel-plated throughout.

J. W. Mason, Kansas City, Mo., who carries one of the most complete stocks of electrical supplies west of Chicago, reports an excellent business. Mr. Mason is the Kansas City agent for the New York Insulated Wire company's brands of wires, and has secured many orders for "White Core" and "Raven Core" wires. He is in a position to furnish almost any electrical specialty on the market and makes it a point to give all orders prompt attention. The prospects for the continuation of the present good business in Mr. Mason's territory are very encouraging.

A California excursion of business and professional men will leave Chicago and St. Paul Thursday, January 2d, and February 6, 1896, in Pullman tourist sleeping cars, over the Chicago, Milwaukee & St. Paul, the Union Pacific and the Southern Pacific railways, via Omaha and Ogden, for Sacramento, San Francisco, San Jose, Monterey, Los Angeles and the fruit districts of California. The tourist sleeper rate—double berth (room for two persons)—from Chicago or St. Paul to San Francisco is $6. Sleeping-car berths should be engaged at once. Send orders for berth, with cash, to F. H. Thorn, city ticket agent, C., M. & St. P. Ry., 365 Robert street, St. Paul, Minn., or C. M. Souther, city ticket agent of C., M. & St. P. Ry., 95 Adams street, Chicago, Ill. For particulars and circulars apply to nearest ticket agent, or address S. Sherin, excursion manager, Palmer House, Chicago, Ill.

It is pleasure to give credit where credit is due, and certainly Western Manager J. R. Wiley and Superintendent of Construction F. S. Vieley are to be congratulated on the Standard Underground Cable company's installation of its cables in the new quarters of the Postal Telegraph-cable company at Chicago. The elaborate article in another column presents many important features of the Postal company's present plant, and from the fact that Standard underground cable plays such an important part in the equipment, carrying, as these cables do, the main lines of the Postal company, it is not to be wondered that the western department of the Standard Underground Cable company feels that its work in the Postal quarters will stand for many years as a monument of a most successful cable equipment. The tests of these conductors show a remarkable insulation that speaks well alike for the cables themselves and the high-class construction work.

In a recent booklet telling "Something About Westinghouse Engines," the Westinghouse Machine company gives interesting details of its methods of testing. It appears that "Every engine, from the five horse power junior to the 700 horse power compound, after being assembled, is taken to the testing room and run continuously for several days under full load and with every condition of actual service. From there it is removed to the overhauling floor and taken entirely to pieces. An examination of the piston and valve rings is then made to ascertain if they bear properly all around; the journals and wearing surfaces are inspected to make sure there is no tendency to heat or cut; and a final and exhaustive search is made for defects of any nature. When everything is known to be right the parts are reassembled, all adjustments made permanent, and the engine is then ready for jacketing, painting and shipment." The company says that its engine is most bitterly attacked on the score of wastefulness of steam, and in order to satisfy buyers it makes this liberal proposition: "The unequaled facilities of our testing shop are at the disposal of any purchaser who may wish to satisfy himself on this point, before placing his order. Not only this, but he is cordially invited to bring his own expert to conduct such test, and may rely on our assistance and co-operation to make it thorough and conclusive. If other engines are offered on the same basis, it is then simply a matter of comparing results—where we are entirely willing to let it stand."

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued December 3, 1895.*

550,574. Electric Arc Lamp. Thomas E. Adams, Cleveland, O. Application filed March 14, 1895.

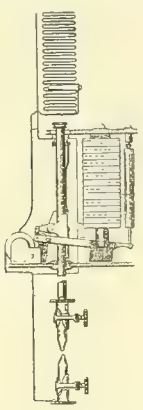
A clutch comprising a saddle is adapted to bear against the carbon rod, and having ears projecting beyond the same, a bifurcated lever is pivoted between the ears, and a shoe is pivoted in the lever and adapted to bear against the carbon rod.

550,577. Electric Switch. Christoph Bach, Jr., Milwaukee, Wis. Application filed April 12, 1895.

One claim is given: In a knife switch, a two-part handle, one part being rigidly connected to the switch blades, and the other part being pivoted to the rigid part, and a retracting spring connecting the two parts.

550,600. Electric Arc Lamp. Stefan Doubrava and Josef Donát, Brünn, Austria-Hungary. Application filed February 2, 1895.

An arc light comprising the combination of carbon holders, a regulating solenoid, a core for the same and side rods for the core, the solenoid being considerably shorter than the core and sliding thereon between its ends, and the carbon holders being directly attached to one of the two elements of the magnetic system.



NO. 530,574.

550,638. Electrical Protective Appliance. Alfred H. McCulloch, Boston, Mass. Application filed September 14, 1895.

A protective fuse is employed, comprising a section of easily fusible conductor smaller at its middle than at its ends, combined with a non-conducting, incombustible sheath applied thereto and surrounding the same, the sheath being loose and porous for the ready escape of gases.

550,663. Dynamo-electric Machine for Plating. William M. Thomas, Chicago, Ill. Application filed March 25, 1893.

The arrangement is such that current may be furnished for two or three circuits of different constant voltage, a field shunt and series coils being arranged in the divided circuits and compounded with the shunt.

550,666. Dynamo-electric Machine. Henry P. White, Kalamazoo, Mich. Application filed January 29, 1895.

The combination includes a suitable shaft, a plurality of armature heads on the shaft with the magnets alternating to act successively and alternately in appropriate fields, a suitable commutator connected to the armatures to receive impulses from the armature heads successively and alternately to utilize a large number of magnets in a revolution of the shaft with a comparatively small diameter of armature heads to increase the power of the machine without increasing its rate of motion.

550,670. Signal Circuit. John V. Young, Boston, Mass. Application filed July 8, 1893.

There is an insulated rail section in one line of rails, a battery, a shunt or "cut-out" circuit including therein the insulated section of one of the lines of rail and one of the rail sections of the other line of rails, and a "relay" circuit controlling a signal or indicator, and including therein the insulated section and the other rail section, the insulated sections in the same line of rails being in such proximity to each other that the circuits including them can be simultaneously closed by the same car or train.

550,682. Voltmeter. Frank Holden, Schenectady, N. Y. Application filed August 31, 1895.

In an electric measuring instrument, the combination of field coils, an indicating coil mounted upon a shaft and provided with an index, hubs also mounted upon the shaft and connected to the terminals of the indicating coil, and zigzag flat springs secured at one end to the hubs and at the other to circuit terminals.

550,683. Trolley Wire Crossing. John C. Kinney, San Antonio, Tex. Application filed April 17, 1895.

The separate triangular-shaped brackets or arms are bolted to an insulating block or core, with a round-ended cone at bottom part of the same size as the trolley wire, and having two independent bolt holes for bolting the brackets or arms in pairs, insulated from each other to the insulating block or core, thus giving a continuous current without interferring with the cross line.

550,686. Electric Cigar Lighter. James F. McLaughlin, Philadelphia, Pa. Application filed April 24, 1893.

A heating conductor is disposed between layers of asbestos with a superposed sheet of wire gauze, and suitable circuit connections.

550,688. Electro-therapeutic Apparatus. Charles Palmleaf, Seattle, Wash. Application filed April 1, 1895.

An induction coil having a hollow or tubular core, an auxiliary core provided with a series of spirally arranged perforations.

550,692. Armature. Henry G. Reist, Schenectady, N. Y. Application filed August 31, 1895.

In the armature shown the core has notches of two different sizes, a series of main coils in the larger notches, and a second series of smaller or "teaser" coils in the smaller notches, one end of the series being connected to the middle of the series of main coils.

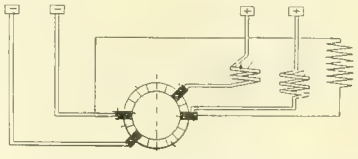
550,703. Commutator. Henry P. White, Kalamazoo, Mich. Application filed January 29, 1895.

One claim follows: In a commutator, the combination of conductor members in pairs, each pair of which is independently connected, and each member of which is insulated from the other, a member of each pair permanently connected in opposite ends of an electric circuit, an equal number of commutator sections to each member connected with said members alternately and successively; brushes for traversing the commutator sections to commutate a current either to or from the electric circuits.

550,728. Automatic Telephone Exchange System. James G. Smith, New York, N. Y. Application filed February 18, 1893.

The last claim says: In a telephone system, the combination with a central office switching apparatus for connecting subscribers' circuits, and a subscriber's circuit including a number of subscribers' stations, of an electro-magnetically controlled shunt switch at each station, a normally closed shunt controlling circuit including all of the shunt switches, whereby the subscriber's circuit is normally maintained through the instruments at all the stations, a local shunt controlling circuit at each station with contacts therein moved by the shunt switch to break the local circuit when the switch is released by the main shunt controlling circuit, and a switch at each station for breaking the main and establishing the local shunt controlling circuit, whereby all the shunt switches save that one will be operated to shunt the instruments at their stations respectively.

550,729. Automatic Exchange System. James G. Smith, New York, N. Y. Application filed February 20, 1893.



NO. 550,663.

In an automatic exchange system for telephonic and telegraphic purposes there is the combination with a plurality of main or trunk lines, and independent automatic switches at each end of the trunk lines independently controlled from the subscriber's station, of a loop circuit connecting the switches at each end and a local subscriber's station, and circuit connections between the same and the switches for controlling the latter, whereby a complete metallic circuit may be automatically formed between the distant stations.

550,733. Electric Safety Device. Elihu Thomson, Lynn, Mass. Application filed May 19, 1887.

The combination is claimed with electric main supplying devices in multiple, of a lightning arrester for both poles of the circuit, an arc-rupturing magnet or magnets for rupturing an arc following a discharge over either pole, and means for rupturing a cross or short-circuit from one main to the other through the lightning arrester resulting from a discharge to ground from both mains together.

550,765. Signaling Apparatus for Telephone Switchboards. Charles E. Scribner, Chicago, Ill. Application filed April 16, 1895.

A source of current and a signaling instrument are adapted to be displayed when excited by a predetermined current, a shunt about the signaling instrument forming with a portion of the signaling circuit a closed local circuit through the signaling instrument including a source of current, the current in the local circuit being almost sufficient to display the signal.

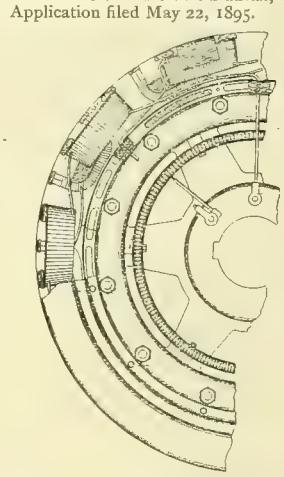
550,782. Method of Distributing Electricity to Electric Lighting Systems. Charles M. Davis, Chicago, Ill. Application filed April 14, 1892.

A source of electrical energy of continuous direction; sets of converters and alternators are employed, the several sets being arranged at different phases and in multiple one with the other.

550,822. Self-winding Electric Clock. Charles M. Crook, Chicago, Ill. Application filed March 25, 1895.

In an electric winding device, in combination with the electro-magnet, its energizing circuit and its armature a lever which carries the armature, the main spring, a spiral sheave suitably connected to the main spring to wind it up when properly rotated, a flexible strap, chain or cable connected to the armature lever and running thence about the spiral sheave and secured thereto.

550,823. Electric Meter. Thomas Duncan, Fort Wayne, Ind. Application filed May 22, 1895.



NO. 550,692.

The combination in an electric meter of a retarding mechanism consisting of an aluminum disk traversing the field or fields produced by one or more permanent magnets having their like poles upon the same side of the disk, and a magnetic shield.

550,841. Electrical Measuring Instrument. Herschel C. Parker, Brooklyn, N. Y. Application filed May 9, 1895.

There is the combination with a base, of a magnet supported thereon, a frame embracing the poles of the magnet, a coil arranged between the poles, a spindle at the upper and lower portion of the coil, and having bearings in the frame, an arm extending upwardly from the base and thence to the center of the coil, a sleeve carried by the extremity of the arm, two springs connected to the arm and to the upper and lower parts of the coil respectively and arranged within the sleeve, an indicator carried by the coil, a scale and electrical connections

550,857. Electric Time Alarm Attachment. Max Wolff, New York, N. Y. Application filed July 3, 1895.

The combination includes an alarm post of a clock or like mechanism, an electric circuit including a generator, and an alarm, a back board separating the two and provided with an extension at one end adjacent to the terminals of the circuit and located between the same, the terminals of the circuit being flexible and connected at their free ends by a block of insulating material, a flexible loop of insulating material connected with the insulating block, and a clip carried by the loop and adapted for engagement with the alarm post, whereby when the alarm post turns the flexible loop will be twisted and the terminals of the circuit will be crossed one over the other and brought in contact with each other, closing the circuit.

550,860. Electric Car Lighting Apparatus. William Biddle, Brooklyn, N. Y. Application filed January 7, 1895.

The combination includes a dynamo, having field helices and cores and neutralizing helices, and their pole pieces within the cores of the field helices, a secondary battery, an electro-magnetic pole changer, and circuit connections for directing the current according to the direction of rotation of the armature, and for energizing the neutralizing magnets in proportion to the speed.

550,866. Electric Furnace. Frederic Chaplet, Laval, France. Application filed May 29, 1894.

Features claimed are: The heating chamber, the hollow retort extending into the same to contain the material to be heated, and the carbon pencils arranged to form an arc adjacent to the retort, the retort having its inlet end outside the walls of the furnace and closed by a suitable stopper.

# Western Electrician.

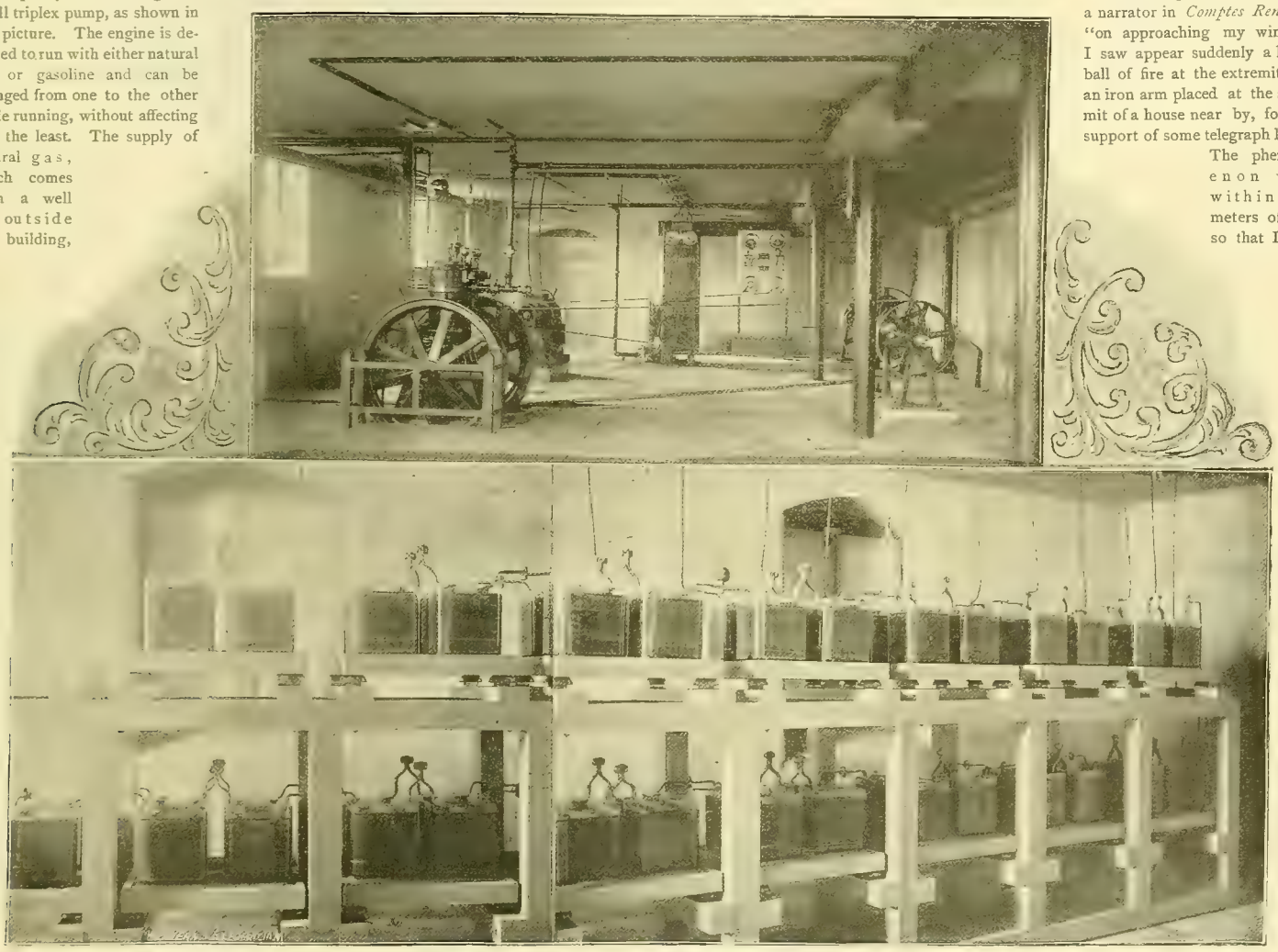
EVERY SATURDAY.

Vol. XVII CHICAGO, DECEMBER 21, 1895. No. 25


## Electric Light Plant Installed for the Franciscan Fathers at Oldenburg, Ind.

This small but interesting plant was designed to furnish light and power for the buildings of the Franciscan Fathers at Oldenburg, Ind., and consists of a 25 horse power Raymond gasoline engine built by the Wallace & Graves Manufacturing company of La Fayette, Ind., a 12 kilowatt bipolar Siemens & Halske dynamo and a 250 ampere-hour battery of chloride accumulators.

The gas engine is belted directly to a jack-shaft, upon which is mounted a friction clutch for the dynamo and a loose pulley for driving the small triplex pump, as shown in the picture. The engine is designed to run with either natural gas or gasoline and can be changed from one to the other while running, without affecting it in the least. The supply of natural gas, which comes from a well just outside the building, is, however, somewhat unreliable, so that provision is made to use gasoline when the supply fails.



ELECTRIC LIGHT PLANT INSTALLED FOR THE FRANCISCAN FATHERS AT OLDENBURG, IND.

The dynamo is the standard type of the Siemens & Halske company, being in this case wound for 150 volts, for charging the entire battery without the assistance of a booster. The field rheostat of this machine contains sufficient resistance to allow of running the machine direct on the lights at 110 volts, if desired.

The batteries are erected on a substantial wooden rack, as shown, and set in sawdust-filled wooden trays, these trays being set up on oil insulators. The battery is contained in a separate room, well adapted for the purpose, and is a model of convenience for examination and handling.

The switchboards, shown in the rear of the room, are separately designed for the battery and the dynamo. The atter is at the left of the picture and has two Weston instruments, six circuit switches, a main dynamo switch and a field rheostat, mounted upon black slate, while the battery board contains two Weston instruments, two automatic switches for overload and underload, two knife switches and two end-cell switches. The battery switchboard was built by the Cutler-Hammer Manufacturing company of Chicago, while the cell equipment was installed by F. L. Merrill of the same city.

The order of Saint Francis, as established in the town of Oldenburg, comprises separate buildings for both the Franciscan Fathers and the Sisters of Saint Francis. In the sisters' buildings there is installed a 400 light multipolar generator of the Siemens & Halske type and a 300 ampere-hour storage battery. This plant was installed previous to the one of the Franciscan Fathers and has given satisfaction. The current from the batteries in both cases is used at any hour of the day for pumping the organs of the respective chapels.

The gas engine shown in the picture is also designed to drive the pump, which fills a number of large tanks on the upper floor of the buildings, these in turn supplying the entire water demand of the plant.

## Chicago Electrical Association.

The Chicago Electrical association, composed of young men interested in or connected with electrical pursuits, is now holding semi-monthly meetings at 1737 Monadnock block on Friday evenings at 8 P. M. Papers are announced as follows: December 20th, "What Next in Electric Railway Work?" J. R. Cravath; January 3d, "The Protection of an Invention," W. Clyde Jones; January 17th, "Armature Windings for Multipolar Generators," F. A. Muschenheim;" February 6th, "Lightning Arresters," W. R. Garton; February 20th, "The Outlook for Electro-chemistry," Bertrand S. Summers.

## A Striking Electrical Phenomenon.

After a dry season of several months rain fell at Grenoble, France, on the 2d of October in the afternoon. The rain-storm was without the accompaniment of either thunder or lightning, although the skies were dark and gloomy, and the storm continued into the evening.

"About eight o'clock," says a narrator in *Comptes Rendus*, "on approaching my window I saw appear suddenly a large ball of fire at the extremity of an iron arm placed at the summit of a house near by, for the support of some telegraph lines. The phenomenon was within 100 meters of me, so that I had a very complete view. The ball, perfectly formed, despite the luminous radiations, was about 0.3 meter in diameter. It had the appearance of a powerful electric light. From the top of the arm support there was a constant gerbe of large sparks, like those from incandescent iron when struck with a heavy hammer. The little sparkling fountain was directed upward.

"After a time—40 or 50 seconds, I think—the ball suddenly divided into three smaller globes, the largest about the size of a toy balloon. The sparking ceased at once, and the three balls, all like the first as to appearance, rolled down the roof as if acted upon by gravity. Arriving at the gutter—possibly touching it, for there were sparks just then—the three balls simply went out, without noise or commotion. Almost immediately after a second ball appeared at the extremity of the arm. This did not remain long, but at the end of two or three seconds it vanished noiselessly. At the same instant from the extremity of the arm there was

a fountain of sparks precisely similar to the first as to size and color, and flowing in the same direction.

"I may add that about 5.30 P. M. a person worthy of credence saw at an interval of a few minutes two balls of fire at the same place, and related the same to me immediately afterward.

"I found the next morning that the arm, which had been vertical, was now inclined very perceptibly from the perpendicular.

"Several of the neighbors have related analagous experiences in other parts of the city."

## A Magnetized Watch in Early Days.

By Ralph W. Pope.

Those who are familiar with the life of the late Franklin Leonard Pope will remember that in his schoolboy days he was brought into close contact with railroad men, and became quite proficient in all the details of the locomotive and the track. His interest in railroad matters never lagged, and had he not been selected by Superintendent Lovett to learn to operate the Hughes printing instrument at Great Barrington in 1858 it is quite possible he would have become a civil rather than an electrical engineer. It was during his career as operator at this country office that he experienced a difficulty with his watch, of which the writer was reminded upon reading a recent article by Clark C. Haskins in the Western Electrician. The nature of his duties at Great Barrington made it necessary that he should carry a watch. Such a privilege was rare in those days, and the best watch within the reach of a person in moderate circumstances was an "English lever." It was a watch of this type, previously owned by his father, that was entrusted to the young man. It was not long before this watch, which had hitherto enjoyed a spotless reputation, began to exhibit certain eccentricities which made it necessary to have it overhauled and examined by the village jeweler. No improvement in its action was perceptible, and the watch was returned and re-examined time after time, but without effect. After despairing of a cure, some of the railroad men were conferred with, and it appeared that although Bridgeport was the end of their run, they did not entrust their timepieces to a city watchmaker. If there was any man in the country who could fix that watch, they informed its owner, "Thode" Heath of Curtisville was the person. It seemed strange that in a little hamlet, three miles from the nearest railroad station, should be found the only watch expert who was considered equal to any difficulty that might be encountered in his line. At the first opportunity the demoralized watch was entrusted to Mr. Heath, and in due time the owner was sent for. Upon reaching Mr. Heath's "laboratory" the watch was produced, and the expert said: "Young man, what kind of work are you engaged in?"

"I am the telegraph operator at Great Barrington," he replied.

"That accounts for it then. The trouble with that watch is that it has a steel balance wheel, which has become magnetized. Possibly it can be cured by substituting a gold balance wheel."

This diagnosis was no doubt correct, although made in 1858 by a country watchmaker, and probably before he had ever heard of such a thing as a magnetized watch.

It may appear strange that a watch should have thus been affected, considering the comparatively weak currents ordinarily used in telegraphy, especially on this line, which was only 25 miles in length, and energized by a Smee battery of 20 cells at each end. Those who are familiar with the construction of the old Hughes printer, however, will remember that on the right-hand side of the instrument was a large horseshoe permanent magnet, standing with the poles uppermost, and supported in an upright position by being fastened at the bend to the base of the machine. The operator, standing at his work (especially if he stooped, as was usually the case in manipulating the keyboard), was frequently close to this magnet, so that it was quite probable that the watch in the upper vest pocket was occasionally under its influence. Whether this was actually the case or not, the watchmaker fitted the watch with the gold balance wheel, and, so far as the writer knows, there was no further cause for complaint.

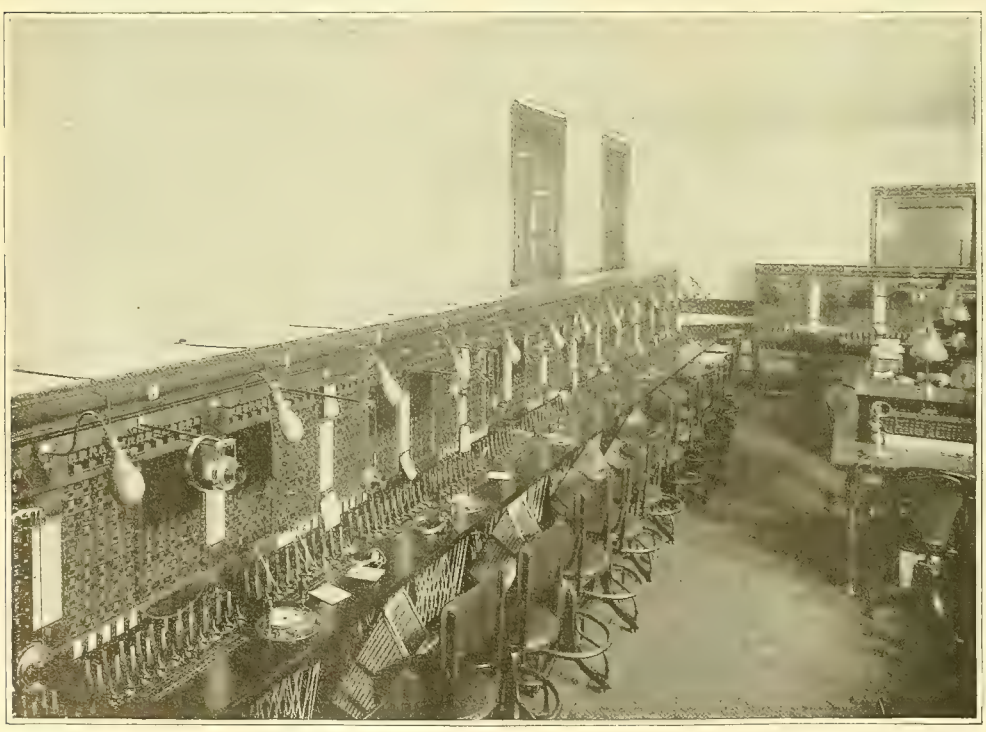
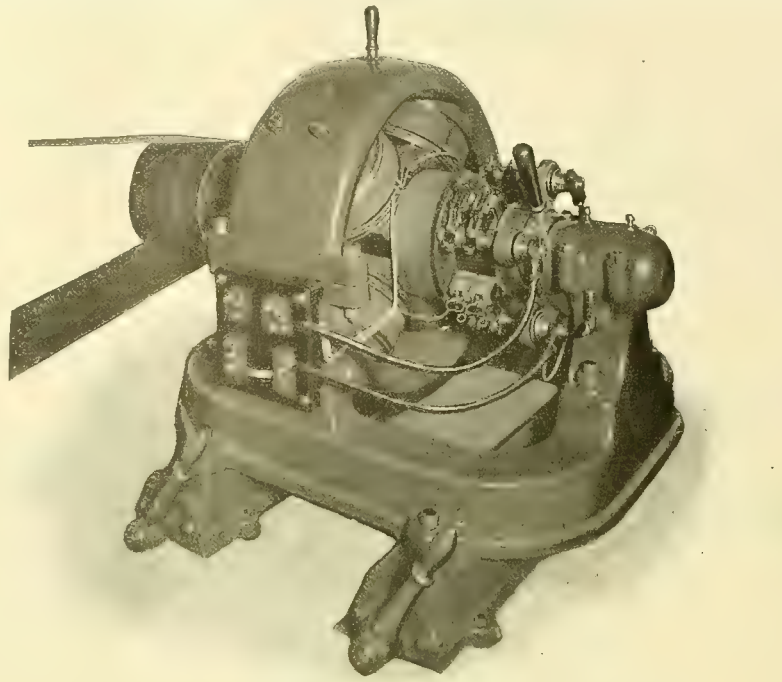


FIG. 1. THE CALCULAGRAPH IN TELEPHONE SERVICE.—VIEW OF "LONG-DISTANCE" SWITCHBOARD EQUIPPED WITH THE INSTRUMENTS IN NEW YORK.

## Gates Multipolar Dynamo.

The new Gates dynamo, illustrated herewith, is the result of the experience of its designers in the erection and construction of a large number of dynamos during the last 15 years, particularly with direct-connected machines. In attaching dynamos to engines in crowded basements of large office buildings, and in other confined spaces, difficulties were encountered which were borne in mind in the design of this new machine. It will be noticed from the cut that either of the lower field blocks can be removed from the magnet ring for inspection without removing the armature or outer bearing. The belted machine differs from the direct-connected only in that it has a sub-base and sliding rails and in the speed. Both pedestals in the belted machine are removable, so that the armature can be taken out through the side, or by removing the upper yoke through the top. The idea of the Gates company was to simplify the machine in its construction as well as in the erection and handling afterward. That this has been accomplished is shown by the fact that from one pattern 18 different machines are built.



GATES MULTIPOLAR DYNAMO.

Open hearth steel pole-pieces are used, bolted to a cast-iron yoke. The armature is of a slotted ventilated type, with flexible bar winding. The commutator has removable segments, and on this feature great stress is laid. The company claims that it has overcome armature reaction by large field pieces with shoes and a heavy field charge. The armature and commutator are mounted on a sleeve through which the shaft for either the direct-connected or belted type is afterward placed. The illustration shows a belted machine of 25 kilowatts, designed to be operated at 850 revolutions.

These dynamos and a corresponding line of multipolar motors are built by the Gates Electric Manufacturing company, 1139 Monadnock building, Chicago, which has received flattering letters of commendation in relation to machines already installed.

## American Street Railway Association.

At a meeting of the executive committee of the American Street Railway association, held in St. Louis on December 9th, the Southern Hotel was selected as the headquarters for next year's convention in the city named. The meetings of the association will be held in the Olympic Theater, across the street from the hotel. The hall for exhibits has not been selected yet. The local committee is already hard at work, and is planning to make the convention of 1896 a memorable one. Secretary Penington suggests that prospective visitors make early reservation of hotel accommodations, as a large attendance is expected. Interesting topics of discussion have been selected, but the complete list of papers and authors will not be ready for some time.

Prof. Bigelow of Washington suggests the idea that the earth acts as the armature of a great dynamo, and by revolving in the sun's magnetic field generates the so-called earth currents of electricity. Mr. Lang thinks that by wrapping the earth with a suitable system of conductors, power could be obtained, and he even goes into a calculation how much it would be. The cost of such a plant would be, of course, enormous.

## The Calculagraph in Telephone Service.

In the early days of telephony exploiters found considerable difficulty in securing recognition for their scheme as a commercial possibility. The public was inclined to regard it as a scientific toy or a luxury in which only a chosen few could indulge. Under these conditions it is not to be wondered that the telephone companies' principal efforts were directed toward getting the people to use the telephone, and one of the inducements held out to subscribers at the time was that they could use the lines as long and as often as they saw fit. Now, however, the conditions have changed, especially in large communities and on the lines of the Long-distance company, and one of the great problems confronting the telephone companies is how to restrict the use of the telephone within reasonable bounds, so that important lines will not be constantly used by persons who could transact their business in much less time and with equally satisfactory results if they were compelled to do so.

Naturally, the first solution that suggests itself is the toll system, and this has been attempted, but the successful adoption of this plan involves many serious problems, and one of the first that confronted exchange managers was the question of seeuring a reliable system of recording the time occupied by subscribers in conversation. It was found by actual experience that where the company depended upon the operators to make a note with pen or pencil, on tickets or blanks prepared for the purpose, little reliance could be placed in the records. The arrangement was unsatisfac-

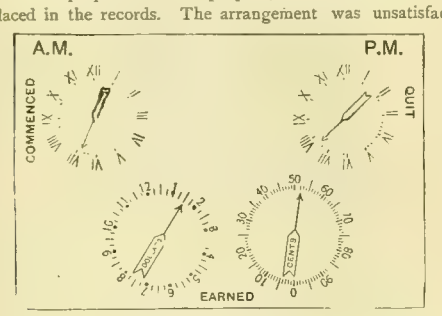



FIG. 5. THE CALCULAGRAPH IN TELEPHONE SERVICE.—RECORD OF EARNINGS.

tory to the company as well as to the subscribers, and was a source of many disputes. An idea of the trouble that was encountered can be gained from the experience of one eastern exchange, where a determined effort was made to devise a scheme by which the time occupied in conversation would be an important factor in the cost of the service. When the new rule was introduced the chief operator discovered that during busy parts of the day operators were in the habit of making half-a-dozen connections before recording any of them. An inspection of the cards showed in some cases that one operator would make six to 10 connections at exactly the same time—according to the records in the company's office—upon which it was necessary to compute the bills of subscribers. This, of course, was an impossibility, but it seemed equally impossible to correct the practice. In one case this was explained by the fact that the clock in the operating room was located in an inconvenient position and most of the young ladies were obliged to turn about and look at the clock each time they received a call, if they were to comply with the requirements of the company. Taking advantage of this experience, another exchange, also in an eastern city, purchased a large number of stop watches for its operators, but this only partially overcame the difficulty. The main objection to the scheme was the absence of some accurate and reliable method of recording the actual time of conversation so that it could be demonstrated beyond question not only that the service was given but that it was furnished at a certain time. To those who have had experience in long-distance service or in exchanges centrally located, from which many lines extend out to neighboring towns and villages, and where the business interests and social life of these numerous communities are so interwoven as to be practically a unit, the importance of this problem will be at once apparent.

About two years ago it was proposed to introduce the

FIG. 2. THE CALCULAGRAPH IN TELEPHONE SERVICE.—VIEW OF INSTRUMENT COMPLETE.

calculagraph into this service, and arrangements were made to conduct extensive experiments in a New York exchange. Several instruments were placed in actual service, and during the last year they have been relied upon absolutely not only in "long-distance" service, but in the "toll" department of the local service. In the accompanying cuts Fig. 1 gives a partial view of the switchboard of the American Telephone & Telegraph company at New York, equipped with these instruments, and Fig. 2 shows the appearance of a single instrument completed and ready for service. It should be mentioned in this connection that the calculagraph is a combination of a clock and recording apparatus by which mechanical calculations and printed records of the net results are made. Tickets are used upon which the several records required are stamped. Specimen records are shown in Figs. 3 and 4, these cuts being reproductions of tickets used by the Central Union Telephone company, and in Figs. 5 and 6 two additional forms are given, by which it will be seen that calculations of money earned at any standard rate per unit of time can be produced as readily as the record of the time occupied in a telephone conversation. This, it will be readily understood, makes the instrument applicable to many fields, including messenger service, billiard and pool rooms, livery, bicycle and boating companies, as well as in factories and shops employing many operatives and clerks.

Returning to the subject of telephone toll service, it is admitted by the managers of large exchanges that thus far it has met all the requirements of service. The instrument, can be used by operators without special training, as the method of operation is very simple. At the beginning of a message the ticket is inserted in the slot at the front of the instrument against the guide and is shoved to the right until it fits in the corner. The right-hand lever is then pushed backward and forward; this records the time of day and also makes an impression of the two dials at the left, but not of the pointers, Fig. 3. At the end of the message the ticket is again inserted in the slot in the same position as before and the left-hand lever is pulled forward, thus printing in the center of the two left hand dials the two pointers, as shown in Fig. 4, which will point toward the figures which represent the exact length of time which has elapsed since the first impression was made.

Thus, it will be seen, these instruments record the time of day a connection is made for a conversation, the time which elapses between the first "ring-up" from the subscriber or the local exchange to the time when the person wanted at the distant city is secured and communication is completed between the two persons who wish to talk, the time which elapses during the actual talk, on which time the charge is based according to the distance covered, and the time which elapses during an interruption of a conversation from any cause, so that the interrupted time may be deducted from the total elapsed time, in making the charge to the customer. It will thus appear that for the telephone service of the American Telegraph & Telephone company the calculagraph performs four separate and distinct offices. Long-distance exchanges have been equipped with these instruments at New York, Boston, Providence, Troy, Buffalo, Philadelphia, Pittsburg and Chicago, and many local companies in the cities already named and in others have begun to use these instruments in local and suburban service. The parent company is known as the Calculagraph company of No. 2

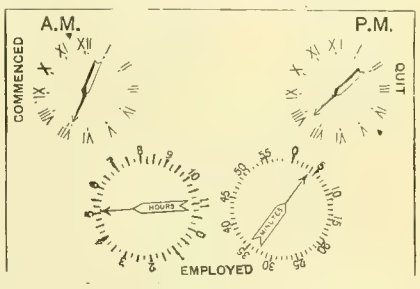
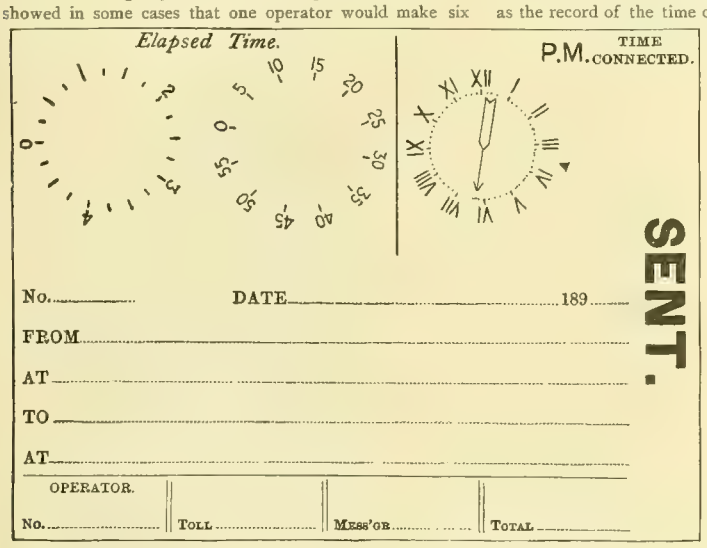
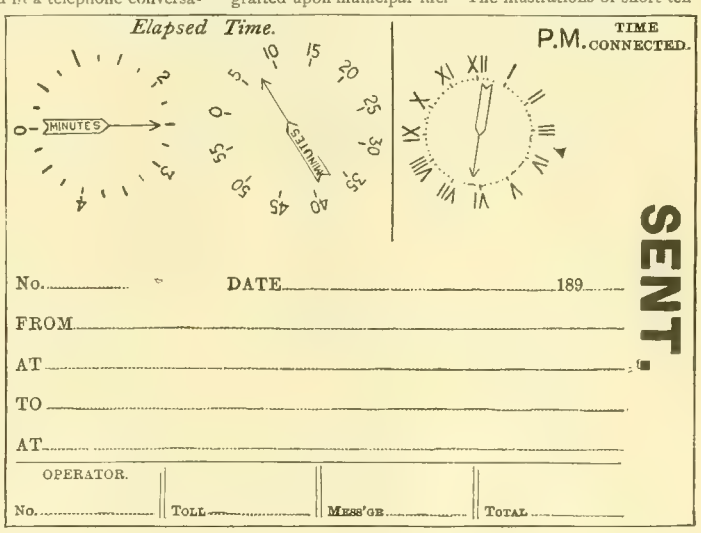



FIG. 6. THE CALCULAGRAPH IN TELEPHONE SERVICE.—RECORD OF TIME EMPLOYED.

Maiden Lane New York. The Pope Manufacturing company will represent the company in Chicago.




FIGS. 3 AND 4. THE CALCULAGRAPH IN TELEPHONE SERVICE.—TICKETS USED BY CENTRAL UNION TELEPHONE COMPANY.

## Mr. Yerkes' Views on Municipal Ownership Commended.

[From the *Chicago Chronicle.*]

Though Mr. Yerkes' motive in decrying municipal ownership of street car plants is obvious, yet his statement in the main is correct.

It is idle to talk of municipal ownership of gas companies or street car lines until the merit system is thoroughly engrafted upon municipal life. The illustrations of short tenure of employes under the municipal system and the extravagance in the number of employes before elections, indeed the various objections and illustrations made by Mr. Yerkes against the general suggestion of municipal ownership, are true as the case stands. But if after many years' experience of a real merit system the municipality should conclude to enter the domain against which Mr. Yerkes as a public-spirited citizen makes protest, the story would be altogether different.

Socialism is involved in the proposition that the city shall control its own streets in the common interest. It is limited and beneficial socialism. But the conditions must be just right before it can be made a success. Not in this generation would it be possible for the municipality thoroughly, economically and satisfactorily to operate street cars or gas works.

## The Multipolar Series Reversible Mill Motor.

For operating heavy machinery in rolling mills and foundries, for swing-bridges and traveling cranes—in fact, in all places where a strong, simple and serviceable machine is required—no power can be more adaptable than the electric motor. The accompanying cuts show the Card series reversible multipolar motor and controller, manufactured by the Card Electric company, Mansfield, Ohio.

Fig. 1 shows the motor completely enclosed; thus the machine can be used in places where the open type of motor would soon be destroyed. This motor, in connection with improved controller and current regulator, makes a very desirable outfit for operating traveling cranes, turnbridges, hoists, bending rolls and other kinds of machinery which require various speeds in either direction. Attention is called to the method of mounting this motor for general work. The front of the motor is supported on a cast-iron stand rigidly fastened to the bed-plate of the machine or other foundation, with trunnions on each side of the upper part, taken through suitable bearings on the motor case, forming a pivot for the motor to swing on. The rear part of the motor is supported on springs at each side, with springs above, held in compression by bolts through the pedestals, which support them and which are also fastened to the bed-plate. The object of this arrangement is to provide a flexible support for the motor and a cushion for the gearing when heavy loads are thrown on the motor or the direction of rotation is suddenly reversed. In practice it has been found to work admirably, and, in addition to saving the gears, gives the motor a noticeable advantage in starting heavy loads at slow speed. Where the conditions are such that the spring suspension is not advisable, brackets are provided on the motor for bolting to the bed-plate or foundation rigidly.

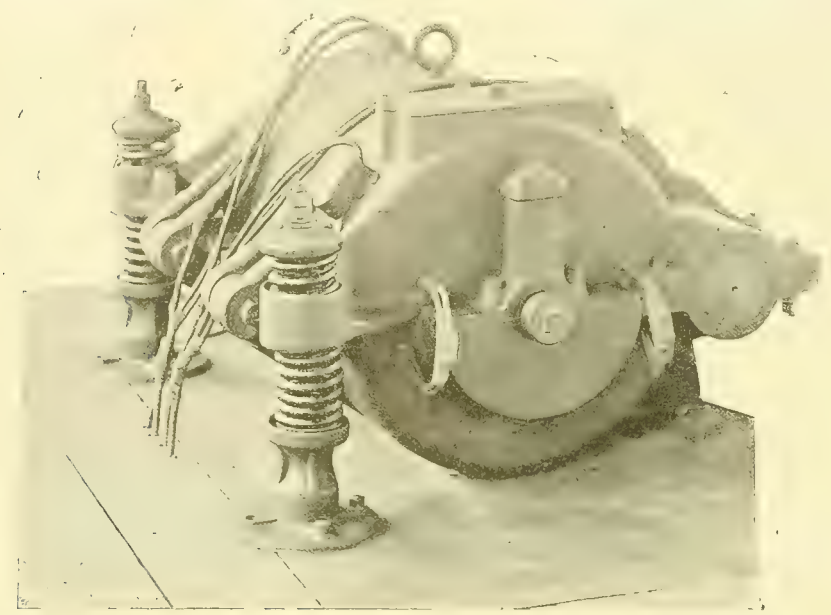


FIG. 1. THE MULTIPOLAR SERIES REVERSIBLE MILL MOTOR.

To satisfy the class of work for which this motor is designed, nothing but the best material can be used with safety, and the construction must be as thorough and complete as it is possible with modern tools to make it. Special pains have been taken in the design to provide large bearings for the armature shaft and other parts subjected to strains and wear, and in every part a generous excess of metal is allowed for mechanical strength and as a factor of electrical safety.

Fig. 2 represents the controller with the lever in a vertical position for current "off" and the door open, exposing the mechanism for regulating the current. Fig. 3 shows the back removed, exposing the wiring and connections to contact fingers. The controller is strongly put together and finished with iron filler or japan, as desired. The working parts have received the most careful attention. They are practically self-contained, and with the exception of the operating lever are fastened to a back made in one piece, which can be removed from one case to another without disturbing any of the parts. Each controller is provided with two revolving cylinders, geared together and operated by the lever, at the top of which is fastened a series of contact rings. The one at the right is used exclusively for opening and closing the circuit and has 24 contacts. These contacts are so arranged with reference to the motor winding that arcing is impossible. A separation of one-sixteenth inch between rings and contact arms will open the circuit without carrying current across. The cylinder at the left carries the reversing rings and others for regulating the flow of current through the motor. Of these there are 10, and the resistance between them is so proportioned that no spark follows when a change is made, no matter how slowly the lever is moved. Near the bottom of the controller is a series of binding blocks for making connection to the motor, current regulator and the line. These binding blocks are plainly marked with letters and figures and correspond with others on the motor and regulator. With each controller the company sends a diagram of the wiring. The cylinders for starting and regulating the current are compact and strong, with ample insulating resistance for use on any circuit up to and including 500 volts and have sufficient metal in the contacts to carry a large excess of current without heating.

## The Abendroth & Root Company's Legal Victory.

On November 19th action was begun by the Philadelphia Edison Electric Light company of Philadelphia against the Abendroth & Root Manufacturing company of New York, to recover $34,000, and a countersuit was filed by the Abendroth & Root Manufacturing company against the Philadelphia Edison Electric Light company for $6,830.99. This suit was tried in the United States Court in Brooklyn, before Judge Wheeler and a jury, and a verdict was given in favor of the Abendroth & Root Manufacturing company for the amount of the countersuit.

The Abendroth & Root Manufacturing company manufactures the Root water-tube boiler, and between the years 1889 and 1891 furnished the Philadelphia Edison Electric Light company about 3,500 horse power of boilers, these boilers being supplied on four different contracts, each of which followed the other at short intervals.

Soon after these boilers were erected and in operation in the Philadelphia Edison plant, a series of troubles followed, which finally culminated in a fatal accident. This brought the matter into the Coroner's Court in Philadelphia, where, after a careful investigation by a jury of experts, a verdict was returned acquitting the Abendroth & Root Manufacturing company and holding the Philadelphia Edison Electric Light company responsible.

The troubles mentioned were due, as claimed by the Philadelphia Edison Electric Light company, to bad workmanship, bad material and faulty design, and also to the contractors failing to comply with all the articles agreed upon in the contract, and on these grounds the complainant brought the suit just closed, in which it sought to recover $34,000, which it claimed it had spent in remedying the so-called defects. The Abendroth & Root Manufacturing company claimed that the plaintiff had not paid them all that was due on the orders for boilers, and also for additional material furnished, and on these grounds brought the countersuit mentioned.

The Abendroth & Root Manufacturing company succeeded in the first place in establishing the fact that it had lived up to every article of its agreement and had even done more than it agreed to do.

In the second place it succeeded in establishing the fact that it had used the best material obtainable in the market. In this connection it is interesting to note that the greatest number of breaks occurring in these Edison boilers were reported to be in the item of bolts; and as it is a natural conclusion that the greatest breakage will occur at the weakest point, it was necessary to establish by evidence the fact that these bolts were equal, if not superior, to anything to be found in the market. When these bolts broke, in almost every instance a curious phenomenon occurred. At the point of fracture, the metal, instead of being contracted to a smaller area than that of the bolt itself, retained the original size and area, showing no contraction whatever,

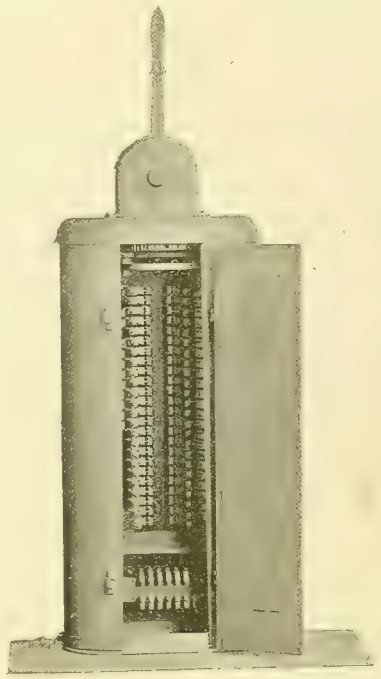


FIG. 2. THE MULTIPOLAR SERIES REVERSIBLE MILL MOTOR.

but breaking sharply and squarely in a similar manner to a pipe-stem. This caused the question to be raised as to whether crystallization had occurred, and to determine this point, many of these bolts were taken to a steam hammer and flattened out cold to less than one-quarter of an inch in thickness. In every instance the flattening was done without the slightest show of fracture running up into the body of the bolt, whereas if crystallization had taken place at the point of rupture the metal would necessarily show brittleness and breakage similar to the action of a piece of cast-iron similarly treated. Another test applied to many

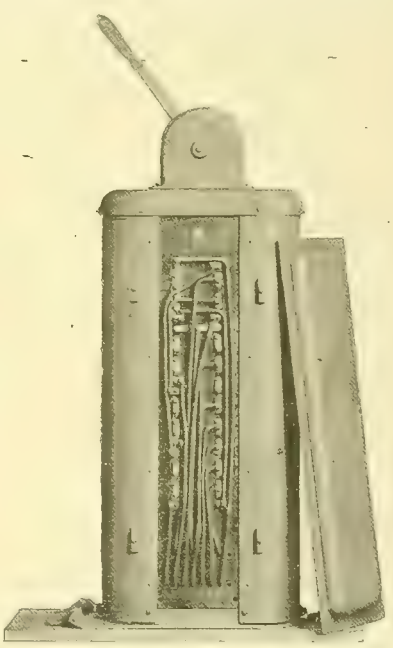


FIG. 3. THE MULTIPOLAR SERIES REVERSIBLE MILL MOTOR.

of these bolts was to bend them double when cold so that the two ends met, and this also proved the excellence of the quality of the bolts. In order to show that no effort had been spared to improve the quality of the material used, the Abendroth & Root Manufacturing company had other bolts made of the best rivet iron, substituted in the place of the original ones, but all such bolts were fractured in identically the same manner, and a still further trial was made with steel bolts, which were affected with the same

results. In order to make this breaking point test still stronger, three-quarter inch bolts were substituted for the five-eighths inch bolts, but with no better results. Beyond this, the shape of the head, and also the shape of the lug which received the head of the bolts, were changed in every conceivable way, but all to no avail, as the fracture of bolts continued in this almost unaccountable manner, whereas fracture in the other parts of the boiler was very infrequent indeed. It follows that no better evidence could be furnished or was needed that good material was used throughout.

To answer the allegation of bad workmanship, the Abendroth & Root Manufacturing company, which has always been very jealous of its reputation, showed by means of photographs the tools which it now uses in the manufacture of boilers, and proved that these tools had been used in manufacturing all of the boilers supplied to the Philadelphia Edison company. As these tools are made to produce interchangeable parts, with cutters and other working details fixed immovably in the same position and adjusted to such positions by sets of templets carefully standardized, and further as the positions of the metal parts of the boilers were fixed from working points produced in the casting, it was found impossible for the plaintiff to show that such workmanship could be other than that produced in the many boilers manufactured by the Abendroth & Root Manufacturing company. Moreover, as such trouble as was experienced in the Philadelphia Edison station has never been known in other plants, it stood to reason that, with workmanship and materials the same, all the troubles at the Edison station must have been due to local conditions existing in the plant itself. This same argument bore also on the fourth claim of bad design.

Futhermore, the Abendroth & Root Manufacturing company succeeded in proving that the accidents were due entirely to the unreasonable handling of the boilers by the Edison company, with the object of forcing these boilers far beyond their rated capacity, sometimes exceeding this rating by as much as 100 per cent. and over. It also showed that the Edison company employed unskilled labor, and that these employes had instructions to keep steam up to the required pressure irrespective of any demands that might be made on the boilers, and that the whole idea was to keep the lights going which the Edison company had contracted to supply, without regard to the personal safety of the attendants or capacity of the boilers.

One of the very important matters brought to light in this case, and acknowledged by the Edison company, was the use of extremely bad feed-water. It seems that the Edison company sunk a well beneath the station, and this was the only water used to supply the station. This water, as was shown by the analysis presented during the trial, contained not a small amount of sewage, and ran 34 grains of impurities to the United States gallon, almost 8 per cent. of these impurities being proved to be sulphate of lime; while salt existed in appreciable quantities, and also a number of nitrates and ammoniacal salts. This water was what might be called the surface drainage of the city of Philadelphia, and as the city has, unfortunately, a very poor sewerage system, this drainage amounts to what might be regarded as sewer water which had undergone a certain amount of filtration in the earth down to the impervious strata along which it ran and finally collected in this well. In order to counteract the bad effects from this water, no small amount of chemicals was used. These were changed at times, and finally the Edison company seemed to settle down on the use of cutch, or what is more properly known in chemistry as catechu, which contains a considerable quantity of tannic acid. In the storage tank located above the boilers large quantities of caustic soda were also put in the water, making so strong a solution that water dripping from it would take the hair off of the horses that passed beneath it, also inflicting serious burns upon the workmen who were so unfortunate as to catch a sprinkle. The result of the use of this bad feed-water was naturally shown in the collection of a large amount of scale in the tubes, varying in thickness from five-sixteenths of an inch to one inch, and thereby closing down very materially the area of the tube opening. The chemicals used attacked the metal parts of the boiler and oozed through the joints thus attacked so as to form incrustations, which had at times almost entirely covered the bolts and bends. This incrustation proved so hard that the workmen were obliged to use a hammer and chisel to remove it. This state of affairs caused a rigidity of parts which were designed to be flexible, and it also caused the unnecessary burning out of many of the tubes.

Another very important point established by the evidence was that an excessive forced draft was used in order to drive the boilers to the unreasonable extent to which they were used, and evidence showed that this draft was sufficient at times to support a column of water from three to four inches in height.

Several well-known experts appeared in this case and accounted for the various troubles here enumerated. One of the most interesting points developed was the production of water hammer in the tubes of these boilers, which was explained in the following manner: It is a well-known fact that every pipe or tube has a definite capacity of discharge, and when this capacity is reached no more water or steam can be delivered through an opening of such an area; so that in case a larger discharge is required, a larger tube must be used. In driving these boilers to such an excessive extent, in the course of natural circulation the water and steam passed up along the inclined tubes to the front headers and there advanced upward into the overhead steam and water drums from which the steam was delivered to the piping system. When the circulation reached a point equal to the capacity of the tube, of course no more steam or water could be discharged from that upper end of the tube, but as the heat still continued to be applied around the tube, more steam was generated, and of course the pressure of this steam in the tube forced the steam and water back down the tube until it reached the rear header and here the steam suddenly had a chance to escape upward by the course of the rear headers to the overhead steam and water drums, and the colder feed and circulating water trying to enter the lower end of the tubes from these same rear headers came in contact with the steam thus seeking passage of escape. The result was a sudden condensing of the steam, which was followed by a rush of water into the vacuum at an exceedingly high velocity, and this water rushed along the tube at about this same velocity until it reached a bend at the end of the tubes. The result was a very sudden and powerful blow there, practically like that of a cannon ball, which caused the bolts to rupture in the manner described, breaking them in fact, so rapidly that a flow of the metal composing them, at the point of rupture was impossible.

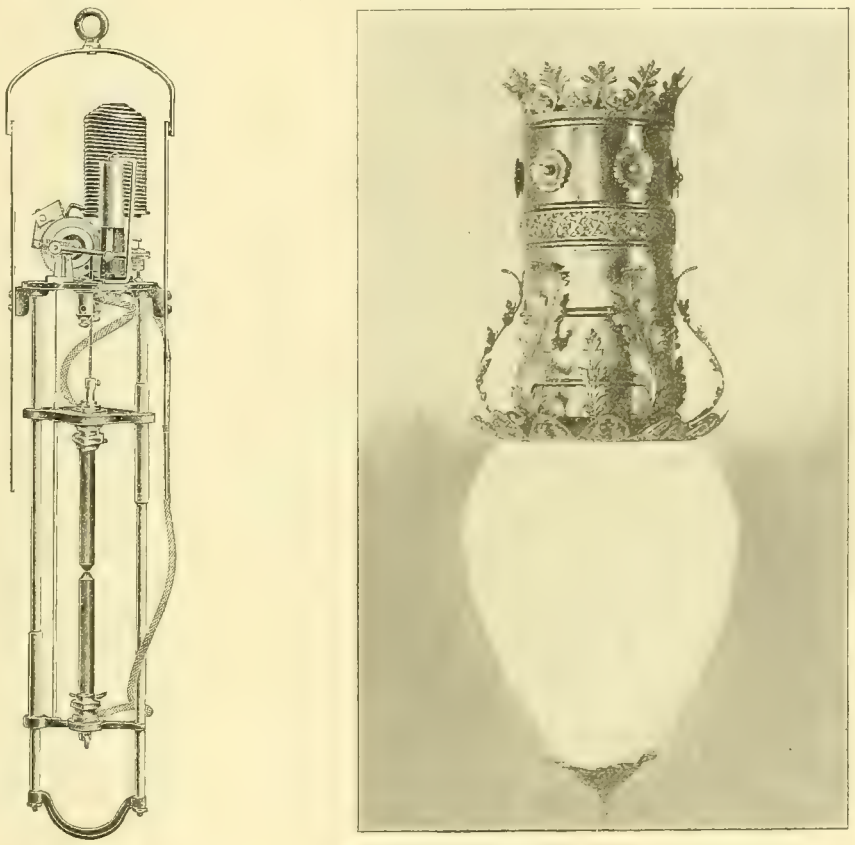
This flow necessarily would take a certain amount of time. The consequences of this sudden blow were exhibited in the breakage of these bolts without contraction of area at the point of rupture. It was remarked during the course of the trial that it was fortunate that these boilers were composed of small headers covered by small castings known as connecting bends, and that thus the damage done affected merely these small castings, producing there local results instead of rupturing large castings, which would, of course, be attended by far more serious ruptures. Glass models were shown at court which illustrated beautifully the theory thus presented. Other glass models illustrated the irresistible power of the water hammer, the force of which was sufficient to break the tubes which held the water surrounded by a vacuum.

The counsel for the Philadelphia Edison company included Tracy, Platt & Boardman, and the counsel for the Abendroth & Root Manufacturing company Benedict & Benedict and Witter & Kenyon of New York. The plaintiff brought in as an expert Prof. Spangler of Philadelphia, while the defendant brought in as experts Dr. C. E. Emery of New York and Prof. R. C. Carpenter of Sibley College, Cornell University, Ithaca. Prof. W. D. Marks of the Philadelphia Edison company and Albert A. Cary of the Abendroth & Root Manufacturing company also testified.

## Alternating Arc Lamps.

The development of alternating current appliances during the past few years has been truly remarkable. In nearly every department of lighting and power they have proved formidable competitors of the direct current apparatus, and that too against deep-rooted prejudice.

In no case has the alternating current demonstrated its adaptability and usefulness in a more striking manner than in arc lighting, especially since the carbon manufacturers have been so successful in producing a first-class article in the way of a cored carbon suitable for this class of work. The advocates of the alternating arc claim that it has all the advantages of the direct current arc, and a great many more beside. Given a lamp capable of good regulation and good carbons, and the alternating arc will produce as much light, if not more, per watt consumed, as the direct current arc. The light, too, especially for indoor use, is claimed to be far more agreeable to the eye, being softer and more evenly diffused and free from disagreeable shadows. Under white ceilings the alternating arc produces all the effects of the so-called inverted arc without the disadvantage of the deep shadow immediately under the lamp. Using the alternating arc in this manner an agreeable combination of direct and reflected light is produced. For outdoor use a reflector is desirable.



ALTERNATING ARC LAMPS.

Another development that is promised is the substitution of the large and efficient alternating unit for small arc dynamos in all large central stations. Alternating lamps can be run in series for street lighting from the primaries or from step-up transformers, and scattering customers can be supplied from transformers, and that, too, on a meter if desired.

The illustrations show a lamp designed for alternating service and placed on the market by the Fleming-Spence Electric company of 652-660 Hudson street, New York. As may be seen, the lamp is as simple as can be made. The regulation is performed by a solenoid and core acting through a system of levers on a most ingenious feeding device. This device is so constructed that it is impossible for the lamp to overfeed or burn a coil in consequence, and there is no delicate mechanism of any kind in the lamp to become clogged or get out of order. The lamp is supplied in various styles of ornamentation, some of which are extremely handsome.

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## HIGH WATER MARK

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HARD times do not seem to prevent the inventive genius of the country from flooding the market with novelties and absurdities of every class and description. According to the Patent Office records there is, and has been during the last year, great activity in this field, and most of us are willing to believe that it is an indication of improvement in trade and financial affairs, but there are some who seem to think that this remarkable showing at this time lends another meaning to the old expression that "Necessity is the mother of invention."

AT this time, when merchants are resorting to all sorts of devices to attract attention and draw the crowds of sight-seers who frequent the large cities, it is well to remember that there is no attraction so interesting to the masses as a brilliant electrical display. Incandescent lamps lend themselves readily to decorative purposes, and the special forms that have been designed for this class of work make it easy for window trimmers and general decorators to utilize them. It should be borne in mind, though, that care should be taken to avoid danger from fire. The wiring should be done by competent men and in strict compliance with the rules, otherwise serious results may follow.

OF late several references have been made by the daily papers throughout the Empire State to the proposed introduction of electricity upon the Erie canal, and in some of these the impression is evidently sought to be conveyed that the problem has been thoroughly canvassed; that the engineers have concluded their work and determined that the project is economical, and that everything is now in readiness to proceed. Such a condition of affairs would be welcomed far beyond the confines of the state, but do the facts warrant these conclusions? Have competent engineers "figured" out the cost? Who are the engineers? Where are their reports to be found?

THAT is a remarkable statement by Mr. Edison which is just now going the rounds of the daily papers. "Our present patent laws," he is reported to have said, "which, as interpreted by the courts, encourage perjury and put a premium on fraud, are worse than a farce." Such a statement, coming from such a source, must create considerable wonder in the minds of those who know how much Mr. Edison owes to the patent system of this country. It is generally admitted that our patent department is not perfect, that there have been irregularities in its administration, and that injustice may have been done worthy inventors, but it seems hardly possible that Mr. Edison should assume to condemn the system in the manner and language which he is reported to have employed.

IT would require more time and study than the average business man can devote to such matters to follow the developments in the Long Island Traction controversy that is now receiving so much attention in New York city. The case has passed from the lower courts to the state Supreme Court; then to the United States Circuit Court of Virginia, and now it is back again in the state courts, and if there is anything left of the property by the time the controversy closes it will not be the fault of the legal luminaries who are at present guarding the interests of their clients. No wonder electric roads fail when they are manipulated by stock jobbers and legal sharks. In this case the property has been attacked on every possible plea, and it is not to be expected that these onslaughts have enhanced its value.

GENERALLY speaking there is an opinion that the only interest street railway companies have in the community is their ability to extract the nickels and dimes of their patrons. That this is not true will appear to anyone who will take the trouble to inquire carefully into the subject. The street railway interests are important and demand protection, and they deserve it, too, judging from their contributions to the city finances. In illustration of this fact it is only necessary to mention one case which is reported in the daily papers of the East, and which does not seem to have attracted especial attention among those who are constantly denouncing street railroad corporations. The taxes on the property of the Brooklyn Heights Railroad company this year amounted to $195,000. It is said that there is not another corporation in the city of churches which contributes so large a sum toward defraying the public expenses.

ONE is compelled to admit the force of the remark that there is nothing new under the sun when such experiences are related as that detailed by Ralph W. Pope in his interesting contribution this week entitled "A Magnetized Watch in Early Days." A few years ago there was as much interest displayed in non-magnetic watches as there is at present in the underground conduit railway. The subject was a fad, and people thought at that time that they had discovered something new, but in this they appear to be mistaken. Mr. Pope relates a story connected with his brother's early experience in telegraphy which establishes pretty clearly that the same trouble was met, recognized and overcome forty years ago as has of late occupied so much attention. The experience, as related in another column, is interesting and should be especially instructive to those who fail or refuse to recognize the work that was done in the early days when telegraphy was the chief branch of commercial electricity.

OF late there have been several accidents on steam railroads which have been attributed to neglect or poor judgment on the part of the interlocking men, and this has directed especial attention to the necessity of surrounding the interlocking crossings with every device obtainable that will provide additional safety. A recognized authority on steam railroad equipment and management, commenting upon a recent accident at an interlocking crossing, said: "The average towerman is liable to errors of judgment and also to absent-mindedness to a surprising degree, and even if this were not the case it is necessary to so surround interlocking plants with safe guards as to make it impossible that such derailments should occur. It is within the limits of reasonable cost by adding electric locking to render ordinary plants perfectly and entirely safe from such accidents as this one, even if the trackmen carelessly fail to maintain the gauge." In view of the attention that is being given to this subject by steam railroad men, the paper by W. H. Elliott on "Electric Locking Circuits for Interlocked Crossings," which is printed on another page this week will be read with additional interest by those who have given especial attention to this class of work. It has been an up-hill fight for inventors to secure recognition and co-operation in their experimental work from railroad corporations, but now these concerns seem to recognize the necessity of developing a thoroughly practical system, and there is no doubt that with the encouragement and assistance they can lend great progress will be made at once.

ONE does not expect much from such a publication as the *Electrical Journal*, but occasionally there is a display of ignorance on the part of the "professor" and the "doctor" in discussing matters of general interest that is astounding, even considering the source. In the last issue, for instance, reference is made to the recent decision of Judge Townsend in the Van Depoele patent cases under the heading: "Underground Trolley Litigation—Thomson-Houston Company Wins a Suit Against Winchester Avenue Railway." But this is not all. Further misinformation is presented as follows:

Judge Townsend, in the United States District Court, has rendered a decision in the case of the Thomson-Houston Electric company against the Winchester Avenue Street Railway company by which the claim of the plaintiffs to the Vanderpoel patents is sustained. The suit was in reality an issue between the General Electric company and the Westinghouse company and called for a perpetual injunction restraining the use of the underground trolley on the Westinghouse roads. The injunction, it is said, gives to the General Electric company the exclusive right to manufacture and sell the underground system. The case will be appealed to the United States Supreme Court.

The facts in the matter are that Judge Townsend, of the United States Circuit Court, at New Haven, Conn., on the 7th inst. handed down a decision by which Van Depoele patent No. 495,443 was sustained, and No. 495,383 declared invalid. These patents are owned by the General Electric company, and the suit was really directed against the Westinghouse company. The patents cover the overhead underrunning trolley and have nothing to do with underground trolleys whatsoever. By the way, the great inventor's name was Van Depoele and not Vanderpoel. This little incident will serve to show how little dependence can be placed in any statement made by Barrett or Hornsby. Through ignorance or perversity they manage to distort and misrepresent facts to suit their convenience.

NOT only North Side merchants, but businesss men and shoppers in every part of the city, are complaining of the poor service that is being furnished by the electric street lighting bureau of the city of Chicago. Even in the down-town district the city street lights are constantly going out, and important thoroughfares are left in total darkness for hours at a time. Here is a sample of the complaints, taken from the *Chicago Tribune* of last Sunday:

Until eight o'clock last night there were no street lights in the down-town district west of Clark street.

Except for the light furnished by the Edison and other private companies the streets were not illuminated, and pedestrians who walked to the West Side or took the Metropolitan "L" trains were compelled to go through dark streets.

Yesterday workmen and electricians were repairing the circuit which furnishes the city lights in that district, and the work was not completed until nearly eight o'clock.

Again on Monday night darkness reigned on the South Side. The *Chicago Record* tells of one instance where a foot pad attempted to "hold up" Dr. Ebert of Michigan avenue when returning to his home. He was attacked on Peck court Monday night just west of Michigan avenue, and when he resisted was fired upon. Fortunately the bullet missed the mark. Dr. Ebert is indignant because the city does not provide safe thoroughfares upon which citizens can safely walk after dark. The *Record* says:

Dr. Ebert said yesterday that he had made repeated complaints to City Electrician Barrett about the illy lighted condition of Peck court between Wabash and Michigan avenues.

This is not the only district that has suffered, and the North Clark street merchants are not the only shopkeepers who have found it necessary to provide street lights and cease to depend upon the city service. Such an outrageous state of affairs is unknown in any other city in the country. And still Barrett has the audacity to seek further extension of the system.

## Coupling Compound Machines in Parallel.

It is generally conceded that two compound wound machines, A and B, will furnish equal amounts of current at the main bus-bars of the board when they satisfy the theoretical condition—

$$\frac{u}{u^1} = \frac{r+R}{r^1+R^1}$$

u being the potential in the armature, the winding being in series and the cables connected to dynamo A; $u^1$ the corresponding potential for dynamo B; r the resistance of the armature of A; $r^1$ that of the armature of B; R the resistance of the series winding and the connections of A; $R^1$ the corresponding resistances of B.

In these conditions, says a foreign exchange, the two machines should act perfectly in paralled. But this state of things is not thoroughly constant, for the least variation of one of these quantities will result in giving one of the dynamos an advantage which may change the second into a motor. It is common practice to unite the positive brushes by a cable of feeble resistance, but this arrangement, while guaranteeing against the reversing of either dynamo, does not completely prevent the change from dynamo to motor, as under some circumstances the transforming current may cross at the brush connections.

The employment of this connection vitiates the formula of equality above, save when

$$r=r^1 \text{ and } R=R^1$$

and consequently $u=u^1$, if the action of the machines is such that normally no current flows from the one machine to the other.

Now, consider the case where the resistance of the armature r of A is superior to that of $r^1$ of B, and assume the resistances of the series windings, etc., are equal and the machines develop equal currents. The potentials in the two armatures are respectively Ir and $Ir^1$. As we have $r > r^1$, the difference of potential at the brush of B will be greater, and it will flow through the special connection, the brushes and the series winding of A, a current flowing to the bus-bars. Consequently the ammeters at the board will show for A an intensity greater than that of B, while in reality the two machines are developing equal currents.

Consider now the case where, the armatures having equal resistances, the series winding and the connecting cables of A are superior to those of B, and suppose that the ammeters indicate equal intensities. Here the potentials are IR for A, and $IR^1$ for B, and as we have $R>R^1$ the potential at the brushes of A should be superior to that at B, and a current should flow through the special connection from A to B. Then the ammeters will indicate equal intensities for the two, when in fact the difference of current furnished by the armatures may be considerable.

Thus we see that ammeters in the machine circuits of compound dynamos operating in parallel, when these are between the brush and its connection with the series winding, are not thoroughly reliable.

To readily equalize the current between the machines, then, it is absolutely necessary to adjust the relative resistances perfectly. Feeble differences of potential at the extremities of the special connection may determine currents of great relative intensity, because of the low resistance of the connecting cable.

In some installations for illumination the dynamos are regulated by their speed, and so adjusted that no current shall flow over the special connection. In this case the relative resistances of the armatures may be disregarded as far as equalization is concerned, and it suffices to adjust the resistances of the series winding and the connection cables in inverse ratio to the fixed maximum output of the machines, to obtain the intensities desired.

The neutral condition of the special connection may be readily shown by means of a simple upright polarized needle within a coarse coil, mounted in derivation upon the special connection. The needle will remain at zero when no current flows, but will indicate at once when the balance is disturbed by pointing to the machine furnishing the current. The speed of the machine is then changed until the equilibrium is restored—quite a simple matter with well regulated machines.

## Electric Locking Circuits for Interlocked Crossings.[1]

By W. H. Elliott.

In locking electrically the levers of an interlocking machine and taking the control out of the hands of the operator after a route has been set and the signals cleared for an approaching train, the use of the crossing is undoubtedly made much safer, as the operator is then unable to change any of the levers that would lead to a derailment. By locking the levers of the derails only, the operator is free to return any signal to danger at any time, and by so doing endeavor to stop a train, should it be a desirable thing to do, but more than this he cannot do. By locking the levers electrically, it is also impossible for the operator to willfully, or through carelessness, cause any damage to the interlocking by opening a derail or switch for a train or engine to run through trailing the points. There are several ways in which the locking of the levers may be accomplished, that which is suitable for one crossing not being applicable to others without going to too great expense, so that with each application the details of the arrangement must depend to a great extent on the nature of the crossing.

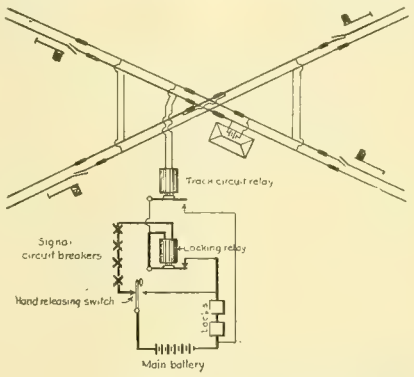



FIG. 2. ELECTRIC LOCKING CIRCUITS FOR INTERLOCKED CROSSINGS.

Probably the first in this field in this country was the Union Switch & Signal company, which strongly advocated the use of electric locking, a proposition being regularly made in their bids for putting in an electric locking device. Finding, however, that owing to the cost it was seldom or never wanted, they, while believing it was a good thing, have not pushed it to any great extent.

The arrangement used by them to lock the lever consisted of an electro-magnet, inclosed in a box and attached to the front rails of the machine in such a manner that when the armature was dropped, it would fall into a notch cut in the outer edge of a disc attached to the flop of the lever it was desired to lock, locking it when the lever was reversed, the circuit through the magnet having been broken by the reversal of the lever. To effect a release, a track circuit placed beyond the limits of the interlocking was used, which was so arranged that not until a train had passed entirely off of the circuit and, therefore, out of the limits of interlocking, could any change of the levers be made. For single track crossings, when a train running toward the crossing would release the locks before reaching the interlocking, mechanical interlocking relays were used, which, by means of a track-locking circuit, prevented the completion of the releasing circuit, until the train had passed entirely over the crossing and off the locking circuit. This virtually accomplished all that was desired with any arrangement of circuits, so that the only claim made for those about which this paper is written is, that no mechanical interlocking relay is used, and the number of circuits has been reduced as much as is possible while accomplishing the end desired.

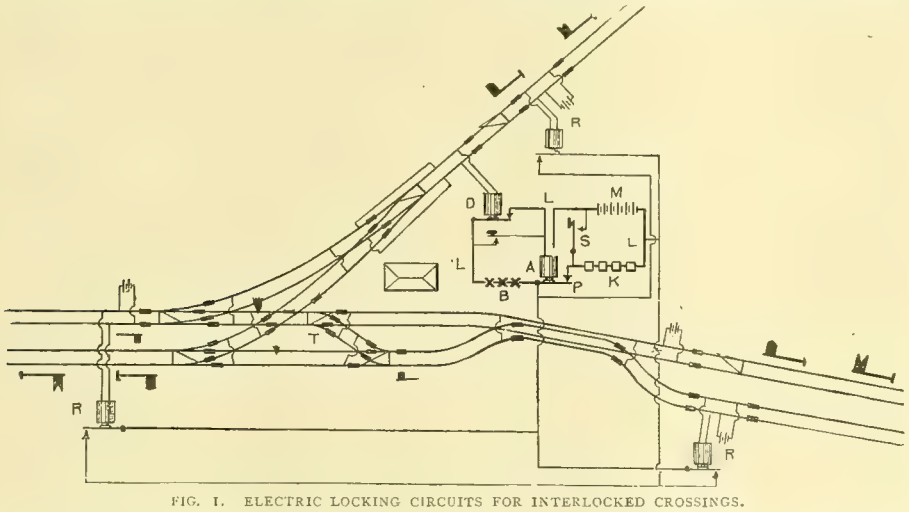



FIG. 1. ELECTRIC LOCKING CIRCUITS FOR INTERLOCKED CROSSINGS.

By doing away with the interlocking relay the releasing is effected entirely by electrical means and there is no chance of the points sticking and failing to release, nor is there any chance for the locks to to be released before they should be by the operator jarring the relay box. In the arrangement shown in Fig. 1 five different circuits are made use of, one a track-locking circuit *T*, a second a locking circuit *L*, used to energize the electro-magnet of the locks and keep them unlocked, and the other three, releasing circuits which are marked *R*, and are used to restore the locking circuit after it has once been broken, thereby lifting the lock armatures and releasing the levers. The locking circuit *L*, which for the sake of distinction is shown in heavy lines, is made to pass through the locking magnet *A*, through the contact points *P* of the relay armature, through the contact points of the armature of the relay *D*, through the locks *K*, through the circuit breakers *B* and the releasing switch *S*, *M* being the battery of about 12 cells, used to energize the magnet *A* and the locks *K*, whenever the circuit is complete. The locks being released and the armature of the relay *A* held up when the circuit is completed, any break in the circuit, as will occur at the points *D* and *B*, will, of course, drop the locks and also the armature of the relay *A*, the armature breaking the lock circuit at the point *P* and preventing the locking circuit from being restored, even if the circuit was again made good at the point where it had previously been broken. To restore the circuit, the relay *A* must be again energized, when the armature would be lifted and a contact made once more at the point *P*. To energize the magnets, a shunt circuit through the points of the releasing relay *R* is used, which bridges the gap made by the points *P* and completes the locking circuit from the battery to the relay *R*, the magnet *A*, the circuit breakers *B* and the switch *S*, the armature of the relay *A* being raised and the circuit completed once more through the points *P* and the locks. But as the resistance of the locks is greatly in excess of what it is through the shunt circuit, not enough current will pass through the locks to energize them so long as the shunt circuit is completed, and they are, therefore, lifted only after the shunt circuit has been broken. From this it will be seen that by passing the locking circuit through the contact points *P* of the relay *A*, and around the locks, the control of the circuit is taken out of the hands of the operator, for while he may break the circuit and lock up the machine at will, he is powerless to restore the locks and must wait for the train to pass out of the interlocking to release the levers.

The releasing circuits, of which there are three, one for each track on which trains usually pass out of the interlocking, are only 60 feet in length, the relay being energized and the armature held up so long as there is no pair of wheels on the track to form a short circuit. When the relay is short-circuited the armature falls and makes a back contact, completing the shunt circuit through the locking magnet *A*, around the locks and restoring the locking circuit in the manner spoken of. As the circuit is completed without passing through the locks, they are not released until the locking circuit through the releasing relay has been broken, so that as long as there is a train on the releasing circuit and the relay is demagnetized, the machine is still locked up. This insures that not only must a train have reached the releasing circuit but must pass out of it before the levers will be released. The track locking circuit energizing the relay *D*, the armature of which when down is made to break the locking circuit and prevent the locks from being released, is used to prevent a train passing over a releasing section on one track from releasing the locks before a train which may be on one of the other tracks has passed out of the interlocking. In this way an operator is prevented from making a mistake and changing the switches in front of any engine that may be working within the limits of the interlocking, and which, for the moment, he may have overlooked. The circuit breakers, *B*, one of which is provided for the lever of each home signal, are used to break the circuit and lock up the machine whenever a home signal is cleared, thus insuring that while the signal may be returned to danger at any time, no change can be made in the switches of the route that has been set. As the locking circuit is the one which is broken when the home signal is cleared, the circuit will, of course, not be restored and the locks released when a train passes out of the interlocking if the signal has not been returned to danger before the last car has passed off the releasing circuit. This means that an operator must attend strictly to his duties, or else he may be caught with the machine locked up when there is a train waiting to use one of the other tracks of the crossing. In case of a failure of the circuits to release, a releasing switch is provided which may be closed and the levers unlocked. This switch is enclosed in a locked box having a piece of glass set in the cover, which the operator has to break before he can get at the switch to close it. In this way a check is had upon his attention to his duties, as every glass broken has to be accounted for and a good reason given, a failure of the apparatus being the only excuse accepted. A second switch enclosed in another box, which is of the same construction as the first, is provided, which when closed will do away with the track-locking circuit without throwing the locking entirely out of service. As it is a somewhat difficult matter to maintain a track circuit where there are many pipe and wire lines crossing under the rails, nine out of 10 cases of failure being caused by some trouble with the track circuit, the use of this switch will be found to give almost the same protection as with the track-locking circuit in use, while admitting of the use of circuits that will seldom or never fail. If at any time changes in the rails or repairs to the interlocking are being made, this switch can be closed by the repairman and the locking feature for the greater part be maintained.

Having described in detail the circuits and the different parts used in locking the levers, the order in which the several operations take place when a train is admitted to and passes out of the interlocking are as follows: When the home signal is cleared the locking circuit is broken by the circuit breaker *B* and the locks and armature *P* of the relay *A* dropped, the armature of the relay *D* be-

1 Read before the Railway Signaling club, November 12, 1895.

ing also dropped as soon as the train reaches the track-locking circuit. When the train reaches the releasing circuit $K$, the armature of the releasing magnet $R$ drops, making a back contact, and completes the locking circuit around the point $J$ as soon as the circuit is restored at the other points where it has been broken. If the operator has restored the home signal to danger, as soon as the train passes off the track-locking circuit the relay $D$ is energized, allowing the circuit $L$ to be completed by the releasing relay when the train has passed on to the releasing section. Completing the circuit $L$ energizes the magnet $A$, attracting its armature and completing the circuit at the point $P$, but without lifting the locks. On the passage of the train off the releasing section, the relay $R$ is energized, breaking the shunt circuit and forcing the current to pass through the locks, releasing them, the levers being left once more under the control of the operator.

Where it is desired to lock the levers of a plain crossing interlocking, a much simpler arrangement can be used than the one described, while practically the same results may be obtained. This arrangement is shown in Fig. 2. As will be seen, only two circuits are used, the track-locking circuit being done away with and the one releasing circuit being made to act as a locking as well as a releasing circuit.

All the other parts, the locking circuit, the locking relay, the circuit breakers, the locks, the hand releasing switch and the shunt circuit through the back contact of the releasing relay are the same as with the arrangement first explained. Using only one track circuit and that a releasing circuit, does not change the action of the locks in any way, as the locks are not lifted in either case until the train has passed off the circuit, which is practically out of the limits of the interlocking. For very complicated crossings where no switching is allowed without the train passing each time outside of the derails, this arrangement will undoubtedly answer all practical purposes, and at the same time be very easy to maintain and cost but little to install. For a plain crossing, such as is represented in Fig. 2, the total cost need not be more than $150, although if the crossing was made at a right angle it would probably cost more, a different system of wiring being required.

## Moonlight Schedule for January.

The moonlight schedule for 1896 has been issued by the WESTERN ELECTRICIAN, and, as usual, there has been a great demand for these reliable tables. The schedule for January is herewith reproduced:

| Day of Month. | Light. | Day of Month. | Extinguish. | Number of Hours. |
|---|---|---|---|---|
| | H.M | | H M | H.M. |
| 1 ... | No light. | 1.... | No light. | 0.00 |
| 2.... | P. M 5.10 | 2.... | P. M. 3 00 | 2 50 |
| 3.... | " 5.10 | 3.... | " 9.10 | 4 00 |
| 4 .... | " 5.10 | 4 .... | " 10.30 | 5 20 |
| 5.... | " 5 10 | 5 .. | " 11 4 | 6.30 |
| 6.... | " 5.10 | 7.... | A. M. 12 50 | 7 40 |
| 7.... | " 5 10 | 8 .... | " 2 00 | 8.50 |
| 8.... | " 5 10 | 9 .... | " 3 1. | 10.00 |
| 9.... | " 5 10 | 10.... | " 4.20 | 11 10 |
| 10 .... | " 5 10 | 11 . | " 5 30 | 12.20 |
| 11.... | " 5 20 | 12 .... | " 6.30. | 13.10 |
| 12.... | " 5.20 | 13.... | " 6 30 | 13 10 |
| 13.... | " 5 20 | 14 .. | " 6.30 | 13.10 |
| 14 .... | " 5 20 | 15 .. | " 6 30 | 13.10 |
| 15.... | " 5.20 | 16 .. | " 6 30 | 13.00 |
| 16.... | " 5.50 | 17.... | " 6.30 | 12.40 |
| 17.... | " 6 5 | 18.... | " 6 30 | 11.40 |
| 18.... | " 7 50 | 19.... | " 6.30 | 10.40 |
| 19 .... | " 8.50 | 20.... | " 6 30 | 9.40 |
| 20.... | " 9 50 | 21 .. | " 6 20 | 8.30 |
| 21.... | " 10 40 | 22.... | " 6 2. | 7.40 |
| 22 .. | " 11 50 | 23 | " 6.2c | 6.30 |
| 24.... | A. M. 12 50 | 24 ... | " 6.20 | 5 30 |
| 25.... | " 1.50 | 25.... | " 6.20 | 4 30 |
| 26.... | " 3 00 | 26 ... | " 6.20 | 3 20 |
| 27.. | " 4.00 | 27.... | " 6 20 | 2 20 |
| 28.... | " 5.00 | 28.... | " 6 2c | 1 20 |
| 29.... | No light. | 29.... | No light. | 0.00 |
| 30.... | No light. | 30.... | No light. | 0.00 |
| 31.... | No light. | 31.... | No light. | 0.00 |
| | | Total ..... ..... ..... | | 218 40 |

## Street Railway Strike in Philadelphia.

The street railway employes of Philadelphia met on December 11th, and formulated a set of rules to be submitted to President Welsh of the Union Traction company on Monday. They declare for 10 hours work and $2 a day; all cars must be vestibuled so as to protect the motormen; all trippers must get increased pay.

A later dispatch states that a general strike was begun on Tuesday. All the lines in Philadelphia are affected, and about 4,000 conductors and motormen refused to work. It is reported that the trolley mail cars will not be interfered with.

H. C. Fairfowl writes from Salem, Ill., to the WESTERN ELECTRICIAN as follows: "The question of issuing bonds for the purpose of constructing an electric plant for lighting purposes is being agitated in this city. There is no doubt that the bonds will be issued. We would like representatives of electric companies to submit plans and the cost of construction of their several plants. We should be pleased to answer any questions."

## Power Consumption on Electric Railways.[1]

BY A. K. BAYLOR.

The subject of power consumption on electric railways se ms to naturally divide itself into two parts—first, the apparatus itself, its efficiency and general construction; second, the handling of apparatus. Properly, a consideration of this subject should start with the coal pile, but it is proposed here to consider it merely in its relation to the electrical apparatus, taking the power as it comes from the engine shaft.

One of the first questions bearing on the efficiency of the generating plant that must be considered is whether direct-connected or belt-driven generators are to be used. In a paper recently read before the Pennsylvania Street Railway association, the writer pointed out that the experience of the last two or three years has shown direct connection to have, in most cases, everything in its favor, and that where land values are high and the units large, these two points alone will dictate the choice of the type of machine.

It was at first supposed that the great fluctuation of load, inevitable in railway work, would introduce a serious menace to the unit (*i. e.*, the engine and generator) when the two were rigidly connected; but this has been shown by repeated experience to be a negligible factor when a properly proportioned flywheel is introduced between engine and armature.

In comparing the two types of machines, the first consideration is apt to be the relative cost. As a direct-coupled generator is usually designed to give a certain output while running at slower speed than a belted generator for equivalent output, it must be large and cost more than the belted machine From this difference in cost, however, must be deducted the expense of belts, and several other money-saving features must be considered.

The direct-connected machine takes less room, saving land and permitting the use of a smaller building. Only one foundation is necessary, instead of two, and although the one foundation must be larger than either of the two necessary for a belted unit of equal power, it will usually cost less than the sum of the two

Furthermore, there are fewer bearings and wearing parts to care for, and last, but not least, a saving in efficiency of from 5 to 6 per cent., according to the proportion of load on the generator. This difference in percentage is due to the fact that the least possible friction loss due to belting is in the vicinity of 4 or 5 per cent., and even if this minimum is preserved at full load, it becomes about 8 or 10 per cent. when the generator is running at half load. These considerations will usually effect a decision in favor of direct coupling, unless they are offset by a saving in interest charges due to an unusually low-priced belted generator.

The next point to be considered seems to be the proper division of the plant into units. Generally speaking, perhaps the best investment is made by the installation of three units of equal size, two of which are capable of carrying the full load. This permits efficient running at half load and full load, and leaves one unit always in reserve. It is, of course, desirable for the sake of efficiency and consequent economy of power to run all the working machines as near full load as possible, and to keep "on top" of the efficiency curve, and, with this object in view, some roads have made a division of power into, say, two large units, each equal to one-half the full load and one small one equal to one-quarter load. This permits full load running practically all the time, as combinations of these machines will give one-quarter load, one-half, three-quarter and full load; but in case one of the large units gives out, the remaining one-half and one quarter unit will have to be considerably overloaded to handle the full load of the station.

It is interesting to note how daily records of current output by readings taken every few minutes will show the separation of the day into distinct load periods which will repeat themselves with astonishing accuracy from day to day when the same general conditions obtain.

For this reason, and because it is impossible to keep playing the generator units into combinations to fit all these fluctuations, it is necessary to choose a generator at the outset with a good efficiency curve; in other words, a "flat" curve, one which rises to 90 per cent. or thereabouts at a comparatively small load, and gradually rises with the load to a high maximum, running then on a practically horizontal line, until the load becomes excessive.

As contributing to this result, the machines should run without excessive heating, which means ample capacity in conductors, commutators and armature, large radiating surfaces, good ventilation and sufficient bearings.

They must run free from sparking up to reasonable overloads, and must have insulation of sufficient resistance to prevent leakages to ground, and, after all this, they must be kept clean.

Buyers should also remember that the manufacturing companies whose engineers have made these points a matter of special study, and have the experience of scores of plants to guide them, ought to be, and are, in a position to judge intelligently of the general proportions best calculated to give a certain result.

The buyers should, therefore, confine their specifications, in a reasonable degree, to a list of conditions to be fulfilled—naming the heating, sparking and overload limits required, with other general features, leaving the means for reaching these ends, *i. e.*, the size of conductors, number of commutator bars, thickness of insulation and the thousand and one details of design which go to make up an efficient machine, to the makers.

A great deal would be gained in this direction if consulting engineers fully realized that unless they have given the matter enough study to qualify them as generator designers, they may, through insisting on some peculiarity of detail and receiving a generator fulfilling their specifications, get a machine inferior to what would have been furnished had the manufacturer been held accountable for results only.

As bearing on the general efficiency of the system, the line should be of ample capacity, and of insulation sufficient to withstand the potential at all times. The ground return capacity should, of course, be equal to the overhead feeder. An abundance of overhead copper with bad rail-bonding, with perhaps open circuits, is an absurdity. As affecting the life of the motors, the feeders should be distributed to deliver as nearly as possible an even potential all over the line, and while the voltage should not be allowed to drop too low, it also should not be raised to any considerable degree above the normal point, as this puts the motor insulation under undue stress.

On this account, when cars run directly past the power house, the feeders should not attach directly to the line, but should spread in either direction and feed back to this point.

It is evident that when a motor has become dusty or moistened in service, its insulation resistance is reduced, and any excess in potential above its safe limit will result in punctures of the winding and other leakages to ground; whereas, if the pressure be kept inside this limit, if only by a few volts, the bulk of such trouble may be avoided.

Of course, the motor is another factor of prime importance in the economy of power, and what has been said under generators regarding efficiency will apply in a general way here. A motor should be as light as is consistent with strength and power, and should be compact and protected by its frame.

The most important consideration in the purchase of motors may be safely said to be cost of maintenance, but this has no direct bearing on the economy of power, much as it has to do with economy of operation.

As a power saver, the most important part of the car equipment is the controller. The time has gone by when it was necessary to draw comparisons between rheostatic and series parallel control in considering equipments; yet a good many lines are operating rheostatic controllers without apparently appreciating the loss they are sustaining. Aside from the out and out saving in power by the use of series parallel control, which amounts to a clean 25 to 40 per cent, according to the series, it should be remembered that the necessary generating plant for operating with such controllers is much less than that required for the same car service under rheostatic control, not only because of the average economy of power, but because the momentary fluctuations of load, which must be taken care of, are much less violent, and this latter condition holds good in any case, even for a high-speed road, making few stops, and where the motors are kept in multiple so much of the time that the average power consumed is practically the same for both methods of control.

Another practical advantage is found in the possibility of running all the cars at half speed in case of the disabling of half the power house capacity. This is an important consideration, for instance on a stormy day, perhaps during a snow storm, when the first desire of patrons is to get aboard cars in large numbers, away from the weather and to be carried to their destination. At such a time the number of minutes consumed in getting there is usually a secondary consideration.

Tracing up the subject of operation at the power house, one of the most effective economies is the use of recording wattmeters registering the load continuously.

By this means, and in connection with readings on individual cars load curves may be established, representing fairly (by the division of the day into load periods, as mentioned above, and the current output during those periods) the power which should be consumed to handle a given traffic. In this way a careful and intelligent comparison may be drawn between different days in a season and between days of similar character.

Wattmeter readings on separate cars are of especial importance, establishing, as they do, for the unit what the station readings show for the whole system. Repetitions under all conditions will show whether a certain car should consume 800 or 900 or some other number of watt-hours in running a mile, and any sudden or wide variation to-morrow from the standard load readings of to-day and yesterday will indic te a leakage of some sort and attract prompt attention. Without such a system of checks in the delivery of current, there is nothing but the sluggish coal pile to betray any irregularity in power consumption.

In addition to these guards, a recording voltmeter should be used at the station or a voltage record kept at very frequent intervals. With due allowance for over compounding, the theoretical record would be a circle, and in practice, with a fairly constant load, the record should approach this standard. If the voltage undergo wide fluctuations, comparing different times of the day, the generator is faulty, or the station man is negligent, and in either case the motors suffer, and they not only require a greater average current to do a given work at reduced voltage, but they will consume more watts in doing it.

A very great factor in saving power is the degree of intelligence of the motormen. They are too often put upon cars with scarcely any preparation and are then practically left to their own devices, and naturally handle their cars uneconomically. They will often move the controller handle around the dial without regard to the notches, passing into No. 2 before acceleration of the first position has been felt, and so on to Nos. 3 and 4. It sometimes practically amounts to throwing the handle immediately into the first position. As far as economy of power is concerned, such men might almost as well have rheostatic controllers. The pity of it is, too, that, as a rule, the men are not to blame, never having received proper instructions.

A valuable aid in the education of motormen is the use of an ammeter in the motor circuit, in plain sight, so that during their run the men can see the fluctuations of the instrument and note the results of incorrect handling as compared with the right method.

1. From *Cassier's Magazine* for December.

The plan followed by Mr. Knox, of the Chicago City railway, is certainly an excellent one. He has printed curves, laid upon one plot, comparing the current fluctuations with right and wrong methods of starting, posted around the car barns and employes' rooms as a graphic object lesson, which has resulted in an economy of power.

Further than this, motormen should be instructed in the car circuits, with diagrams showing the connections at each position of the controller. With this knowledge a conscientious man would involuntarily make an effort in the right direction.

Another great coal consumer is the brake. A great amount of power is wasted by men who throw their controllers into contact before thoroughly releasing brakes, even when there is no danger of backing. They also throw on the brake before throwing off the power.

Very few men understand or attempt to use the momentum of their car to advantage. They will run with power on close up to a leading car and then apply brakes, when they might coast many feet, using no current whatever. This momentum may also be used to advantage on curves, switches or wherever there is unusual resistance.

The careful scheduling of cars with respect to grades may be an important economy, and although it is a complicated problem, it is worthy of more attention than it is usually given.

Care should be taken to keep bearings and running gear in good condition and to maintain track gauges. The wheels upon any truck should be made of the same diameter (a precaution frequently overlooked) to permit the motors to wear in perfect unison.

A full consideration of this heading leads into every branch of the operation of electric railways, and although the efficiencies of apparatus and the direct handling of it are the first things to consider, every fault in system or operation is directly or indirectly an attack on the coal pile.

## Telephone News From the Northwest.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

The Northwestern Telephone Exchange company has completed its long-distance line between La Crosse and St. Paul. There is still a short distance below La Crosse to be built to complete long-distance connection with Chicago and the East. This company is now putting a cable across the Mississippi river at La Crosse. The cable is one inch in diameter and 1,500 feet long. The ice has to be cut through from one side to the other. The cost of the cable is $1,500 and the cost of laying it will be about $200 additional.

The Marquette County Telephone company has 190 instruments in use at Ishpeming, Mich., and 40 at Marquette, and more being added steadily.

The Long-distance Telephone company, which has extensive connections in northern Iowa and southern Minnesota, hopes to make arrangements with the company owning the line from Waterville, Minn., to the Twin Cities, by which the use of their poles may be secured and a line strung to Minneapolis and St. Paul at once.

The Western Electric Telephone company is completing a 40-instrument exchange at Algona, Ia.

W. C. Swift is replacing the old telephone exchange at Grand Rapids, Minn., which never worked satisfactorily, with a new switchboard and new wires.

The Northwestern Telephone Exchange company will rebuild its line from Winona, Minn., to Rollingstone, and put in a metallic circuit.

The City Council of Valley City, N. D., has granted the Northwestern Telephone Exchange company a franchise to operate a telephone exchange.

The suit of Mrs. Sarah Lewis against the Home Telephone company of Sioux City, Ia., for damages for personal injuries sustained by falling head first into a telephone post hole which was not covered, and remaining there for an hour, has been dismissed, the company paying $800 damages.

Assistant Superintendent Fisk, of the Central Union Telephone company, says that operations will begin on the long-distance line between Chicago and Davenport., Ia., as early in the spring as conditions will permit.

Twelve linemen of the Dane County Telephone company of Madison, Wis., struck, demanding shorter hours and better pay. The company promptly discharged them. The company claims the strike was brought about by the Wisconsin Telephone company, for which the men immediately went to work. The Wisconsin company says that it was in no way responsible for the strike, but needed men and hired them when they applied for work.

The Bigelow Lumber company is testing some of the Standard telephones, and if they prove satisfactory will put in six sets for their logging road in Bayfield county, Wis.

## A Ridiculous Pamphlet.

The Indiana Avenue Property Owners' association of Chicago, organized to fight the trolley, has issued a pamphlet of 40 pages containing newspaper accounts of 187 fatalities and 373 serious bodily injuries caused by trolleys in the United States within a recent period. The text of the pamphlet is classified under seven heads—"Death Roll in Chicago," "Slaughter of the Innocents," "Bloody Record in Brooklyn," "Work of Broken Wires," "Increased Fire Risks," "Other Methods Much Better," and "No Legal Right in Chicago." Under the last head are quotations to show that the overhead trolley has no right to exist anywhere.

## The Electric Wiring Question.[1]

BY FRED. BATHURST.

The author commences his paper with an outline of the electrical progress of England as compared with that of America. Both countries were, he says, in 1881 on the same basis; the apparatus was crude, experimental and imperfect, and the knowledge in respect to the safe and proper handling of the apparatus employed was limited, and possessed by but few people. In England in 1883 the possible dangers began to attract attention, and rules and regulations were issued which were to control development and progress. In America no regulations were enforced. In 1887 America had in operation (not to mention innumerable isolated plants) some 70 central stations, supplying over a quarter of a million incandescent lamps. In England at that time there was one central station, supplying about 5,000 lamps, and a proportionate number of independent plants. On the fire question the author quotes the reports issued by the Underwriters' Electrical Bureau. Taking 1893–1894 as two typical years in which public alarm was prevalent in America, reference to the records shows the occurrence yearly of between 400 and 500 fires traced to electrical causes. Some 320 involve no monetary loss, but the remainder (100 to 200) resulted in a loss of £300,000 per year. This sum, though apparently large in itself, is less than 1 per cent. of the total fire loss of some £35,000,000 from all causes. The bulk of the electrical loss occurs in the Western states, and for the more populous Eastern towns the proportionate loss is less than ½ per cent. The loss arising from the use of kerosene oil and matches is appalling in comparison, and the figures are best not quoted. Taking the figures from the United States government records, the average monetary loss per year, for nine years ending 1893, that "lightning" involved amounted to £310,000, or some £10,000 per year more than that caused by the commercial use of electricity. The author, therefore, argues that restrictions of one sort or another have hampered the proper development of the English electrical industry.

The principal obstacle to the general use of electrical applications is that under our present wiring rules it is impossible to place the cost of installation within reach of the great bulk of our people. What is still required is the introduction of rules and regulations which will facilitate the growth of "lower cost wiring." Nothing is further from the author's intention than to advocate cheap, defective, poor, or dangerous wiring. With "lower cost" wiring we could, for instance, successfully compete with the lately introduced "incandescent gas burner," which, priced at about 13s., has had a sale amounting to three-quarters of a million. It is being recognized that the ruling factor which governs public demand is small initial outlay. Even the gas companies are facing the question of fitting consumers' premises free and reimbursing themselves by charging a slightly increased price for the gas supplied.

The five cardinal points of good wiring may be given as safety, durability, convenience, accessibility and economy. Prof. S. P. Thompson, in a lecture on the subject before the Society of Arts, has embodied the essential features in a few words when he said: "What is wanted is a mode of running wires and fixing switches and other accessories, so that they shall not only be electric tight, but shall also be water-tight, gas-tight, air-tight, oil-tight, fire-tight and even rat-tight." It is the author's belief that all these requirements can be met by the use of fire-proof insulating tubes.

It will probably be admitted that wood casing fails in many respects. The idea of its use originated with the telegraphic engineer, and 15 years ago electricians were contented with it. Even on the surface it is neither picturesque nor decorative. It is easy to install, but its nature prevents any very correct or exact estimate being formed of the labor required. If surface work is required on the score of economy, surely it would be better to adopt "open work" on porcelain insulators—a safe and scientific method of wiring, which can be carried out at a very much lower price. We know this system is discouraged; but it is noteworthy that in the only prominent installation in this country where "open work" has been used, the single source of trouble which occurred arose on a circuit in a damp cellar, where, in order to conform with the fire office "requirements," wood casing had been employed. Someone may argue that this could not have occurred if the circuits had been "tested" as the "rules" recommend. Our "insulation test" never yet told far into the future, and it only tells the present to a limited extent. "Insulation test" cannot discover an unsoldered joint or a dangerous diminution in respect to current-carrying capacity. Every practical man will agree that insulation testing will not necessarily indicate that the wires are at places in dangerous proximity to gas or water systems in the event of moisture appearing.

The recognized shortcoming of wood has brought into use iron and "lead compo" piping. Lead compo pipes afford but little mechanical protection in emergency, and, with respect to "accessibility," have serious drawbacks on account of their flexibility. A large amount of "surface leakage" necessarily arises from the use of any ordinary metal tubing. Moreover, if the insulating material on the conductors has from any reason deteriorated and moisture appears, there will be consequent injury both to conductor and tube. Cases have occurred where the protecting fuses on a circuit did not "blow" before electrolysis promoted a dangerous arc which had burnt a hole in the tube and presented a serious fire risk. If a defect occurs anywhere in the insulation of a wire which is within a metal pipe so that there is electrical contact between the conductor and the pipe, the effect of the fault is virtually transmitted throughout the whole length of piping, there to await or invite trouble elsewhere. With two conductors in the pipe a new and unanticipated electrical condition prevails, because one conductor is now of greater carrying capacity than the other, which has been increased by the capacity of the tube itself. Overheating of the intact conductor can now invite serious trouble at any point. This, the author thinks, explains why overloaded wires in pipes have occasionally "burnt out" at several points at the same instant. It must not be forgotten, also, that failure of insulation on one wire means that the voltage tending to break down the other is doubled, and the actual strain ($C^2R$) increased fourfold. Perhaps at this point it will be noticed that these criticisms show, incidentally, how much more the immunity from electrical fires has depended upon the honor and integrity of the contractors than upon the "rules" provided for their guidance. Iron pipes have the disadvantages common to all metal pipes, and, as we know, may rust inside, and this rust is not a condition favorable to "insulation;" they often have burrs or other internal roughnesses which may cause serious mechanical damage to the insulating material as the wires are being drawn in. If iron pipes are screwed at the end for the purpose of jointing, oil is probably employed, and any excessive presence inside is not helpful to a rubber insulation. Cases are on record where this oil has caused extensive mischief. Early in the art of wiring it was recognized that gas brackets, when modified so as to serve as "electrics," should be insulated from the remainder of the gas piping; but now that we are using electric wires themselves in metallic pipes, we appear to overlook the possibility of the electric system being elsewhere in hazardous contact with conjointly installed steam or water systems. It is now apparent that metal pipes, if not actually harmful, are certainly not particularly helpful to the maintenance of insulation resistance.

It may be thought that we must turn away from tube or pipe methods altogether in order to find economic wiring. Experience in other countries, however, does not show that any "rigid" system of conductors is making progress or headway. No insulated wire has yet been produced which in itself can successfully resist the deteriorating influences present in mortar or plaster. Even lead-covered insulating wires, if directly embedded in plaster, have been found wanting, and give trouble from "earths" and "short-circuits" as soon as moisture has made an appearance. With any rigid method, if walls happen to crack and settle, or plasterers and bricklayers cause damage, a fault may develop which is very difficult to find. Usually, also, they are handicapped commercially in respect to making joints and connections, as these involve risk and trouble even with the highest quality workmen. A cardinal objection to "rigid" methods is the lack of accessibility. All good wiring should be accessible, for with this quality assured half the difficulty of "trouble" is already fought, and any imperfection or injury, whether arising from poor work, negligence or accident, can be remedied with a minimum of inconvenience. A conduit or race-way is the practical way of rendering wires "accessible," for then the wires installed in them are always open to the inspection of owner or wireman, whenever he wishes to satisfy himself as to their condition or to effect a renewal. "Accessibility" ought, therefore, to be a fire office requirement; with it an inspector can use his eyes and have no need to trust to his ears for inspection. From the contractor's point of view "accessibility" is desirable as limiting unfair and injurious competition; for, when an installation can be readily inspected, inferior materials cannot be used for the purpose of cutting down prices, workmanship cannot be scamped, and the "death knell" of unprincipled competition could be sounded for all time.

From a labor-saving point of view a flexible conduit would apparently commend itself. While cases do occur where this is true, every flexible conduit has the inherent drawback, as shown by experience, that the property of "flexibility" may so far assert itself that numberless bends will prevent the wires from being drawn out. Any trouble which then occurs will have to be cut out, or else the circuit must be abandoned or wired anew. Flexible conduits are always at a disadvantage, either in respect to moisture-resisting properties, or are wanting in mechanical strength. Bends and elbows must be rigid, or it is impossible to draw the wires in or out; and for the generality of work it will be found that a conduit construction permanently rigid throughout is preferable.

More than half of the cost of the wire used is referable to "insulation," and it is "insulation" we strive to keep. It would, therefore, appear obvious that the conduit should be an "insulating" one. An ideal insulating tube should not only be mechanically strong, but also fire-proof and water-proof. With a tube complying with these requirements all possible electrical trouble is minimized, the insulation on the conductors themselves protected from mechanical damage, and is enveloped in a preservative, rather than a destructive, element. Temperature changes are reduced to a minimum, and if the conduit resists acids, alkalies and gases, the insulating material on the wire is so shielded that its life is indefinitely prolonged. The author contends, therefore, that an insulating tube method of wiring will prove the ultimate solution of the "electric wiring question."

The author then proceeds to describe the method of wiring originated by E. H. Johnson. The insulating material employed is a specially prepared hydrocarbon of the bitumen class. The necessary strength in tube form is obtained by using a peculiar grade of fire-proof paper material which admits of impregnation. The system proivides, the author says, perfect immunity from fire, durability of insulation, accessibility to concealed wires and reliable service. It has had extensive practical test in America, and more recently in Germany, where its reputation for being the safest, least expensive and most practical method of wiring is now established. Already in various countries some two million incandescent lamps are installed in the three varieties of tube—"plain," "brass-coyered" and "iron-armored."

It has been noted that when deterioration takes place in a plain metal tube, the tube itself becomes a conductor, and invites deterioration at many points. If insulated tubes are used (with two conductors inside), the deterioration on one only brings additional stress upon the other conductor at one point. The tendency in this case is to create a "short-

1. Abstract of a paper read before the Institution of Electrical Engineers at London, Eng., November 28, 1895.

circuit" at the spot affected. In these particular tubes a "short-circuit" presents no danger, as the materials of which they are composed will resist the burning effect of the arc. Many tests have been made, and in every case it has been found that the "arc" increased in length until it broke, and severed the circuit without further danger. Any "short-circuit" trouble, then, removes itself, and its injurious effects are confined entirely within the tube. Since the presence of moisture is the principal cause of "short-circuit," the use of these tubes is likely to minimize the occurrence of trouble, because the tube material is non-conducting in respect to heat, and extraneous changes of temperature fail to produce internal condensation. The use of insulating tubes will also remove the increased danger in respect of wires employed for heating or power applications, which may be temporarily overloaded, and in respect of wires protected by a fuse which through careless replacement has been made too large. It may also be that insulating tube methods of wiring will render it possible to materially modify our present practice in respect to "fusing." There is only one point not yet entirely settled. It is whether the two insulated conductors should be kept together or separated—whether one or two tubes should be employed. Owing to the real necessity with a wood-casing system of keeping the wires apart, some authorities urge that this construction should be applied to tube methods, and that a separate tube should be used for each wire. In alternating current circuits it is essential to keep the wires close together, to prevent a drop in voltage from inductional effects. Clearly, therefore, in this case both wires should by preference be in the same tube. In England two conductors are already allowed in "compo" pipes. Theory, in the author's opinion, points to the advisability of placing both wires together, and so far, the results of practice favor this view.

As far as present experience has gone it shows that the bitumenized tube will, under ordinary conditions, last indefinitely. It can safely be embedded in the lime and sand plaster used in ordinary building construction. The present tendency toward fireproof building construction is bringing into use certain cements, caustic enough to attack nearly any material coming into contact with them. The problem thus presented has been successfully solved by the introduction of the "brass-covered" insulating tube. The bituminous material used in these insulating tubes is inert in its nature and exercises no deleterious influence on the insulating material of the wires themselves. It has sufficient mechanical strength to resist any damage except that inflicted by gross carelessness or design, and in the case of chance mechanical injury to the tube the "accessibility" it provides renders repair easy. In respect of permanence and durability the advantage of placing the conducting wires in channels which predetermine their relation to any contiguous conducting bodies is, the author thinks, beyond question. The mischief done to wood casing and "compo" pipe by rats and other vermin is, in the case of these tubes, entirely obviated. From the fact that such inroads are successfully resisted it would appear that bitumen disagrees with a rat's digestive machinery.

An insulating tube system is also economical. With trained workmen it is estimated that a saving from 25 per cent. to 50 per cent. in the labor of installation is made. Even though the tube in itself is comparatively expensive, if wires suitable to it are employed, the total cost of material will compare favorably with any other system. The insulating properties of these tubes is such as to provide (approximately) an additional "300 megohms per mile" insulation resistance to the wire. We are beginning to appreciate the fact that, although we provide a costly "600 megohm wire," after having installed a few hundred feet our tests indicate a total insulation resistance of only a few thousand ohms. An insulating tube system can assist us to obtain a more commensurable result. If a high insulation test has to be obtained in wiring work, practical experience shows there is little doubt that an insulating tube, and its suitably insulated wire inside, is commercially ahead of a relatively heavily insulated wire. Perhaps the limit of economy will be reached when we know how to "earth" perfectly and can use a bare copper conductor within a metal-covered insulating tube.

The author concludes by asking the institution, in considering "the question of electric wiring," in any rules it may issue, to give recognition to, and make due provision for, the use of insulating tubes.

TABLE

*showing the "insulation test" required in the various countries (compiled from rules of supply companies and fire offices), voltage of circuits not to exceed 250 volts.*

| Size of installation wired complete. | Country. England (London). | America (New York). | Germany (Cologne). | Austria (Vienna). |
|---|---|---|---|---|
| Amperes. | Ohms | Ohms. | Ohms. | Ohms. |
| 10 | 500,000 | 2,000,000 | 100,000 | 50,000 |
| 25 | 250,000 | 1,800,000 | 40,000 | 20,000 |
| 50 | 125,000 | 400,000 | 20,000 | 10,000 |
| 100 | ..... | 150,000 | 10,000 | 5,000 |
| 200 | ..... | 80,000 | ..... | ..... |
| 250 | 25,000 | ..... | 4,000 | 2,000 |
| 400 | ..... | 40,000 | ..... | ..... |
| 500 | 12,500 | ..... | 2,000 | 1,000 |
| 800 | ..... | 11,000 | ..... | ..... |
| 1,000 | ..... | ..... | 1,000 | 500 |
| 1,600 | ..... | 5,500 | ..... | ..... |

Rev. Mr. Call secured a verdict against the Western Union Telegraph company for $50 at Grand Island, Neb., for mental anguish suffered by the failure of the company to deliver a message announcing the death of his mother. There is considerable complaint about the service of the company in that place and public interest was aroused over the matter. Mr. Call sued for $1,995.

## Attitude of the Illinois Central Toward Electric Power.

So many conflicting statements have appeared in relation to the position assumed by the Illinois Central Railroad company on the question of substituting electric power for steam service for suburban trains, that the following verbatim interview in the *Railway Review* with Chief Engineer J. F. Wallace possesses much interest.

In 1891–92 I made an extensive examination into the advisability of adopting electric power for the fast World's Fair trains, and with a view to adopting the electric system, if any should be established, for the movement of suburban trains after the exposition. The result of this investigation was that I reported to my superior officers against the adoption of electricity as motive power. The question has not been officially considered by the officers of this company since 1892, although the progress of electrical invention has been carefully watched and I have personally on my own responsibility, as a matter of engineering interest, been following the advances made toward electric traction for heavy suburban railway service. I have frequently said I had no doubt that some time in the near future the Illinois Central would take up and consider this question and that conditions were gradually shaping themselves which would make this application possible; not, however, any from preconceived plans for the adoption of electric motive power, but from the fact that the requirements of the service made the conditions more favorable for taking this step.

I do not think the overhead trolley system will give satisfaction, neither do I consider the third rail system feasible on account of the large number of trackmen working on the terminal and the numerous trespassers crossing and re-crossing the tracks. The application of electricity to a service like that of the Illinois Central will necessarily be gradual and slow, and any system that may be adopted should be such as would permit of the common use of the tracks by steam power as well. In other words, the question of the application of electricity on this road is still in the air; and while current events indicate that the application will be made in the near future, it may be two, three or five years before the question is even seriously considered.

Inside of certain limits electricity seems to be the preferable motive power for moving small transportation units, at frequent intervals and for short distances; while on the other hand steam is the most economical and preferable for handling large units of transportation at infrequent intervals and over long distances. The line of demarcation between these extremes is of course rapidly changing, and the field for the adoption of electric power is gradually increasing as the appliances therefor are more thoroughly perfected and the problems of economical constructions, maintenance and operation are solved.

## Management of the Western Union.

A New York newspaper correspondent says that George Gould is devoted to business these days, and in his modest office in Broadway, near St. Paul's church, controls the operation of the Western Union Telegraph company, whose property amounts in value to over $100,000,000. The Western Union company is one of the largest corporations in the world. Some financiers think that the operations which led to the consolidation of nearly all of the telegraph corporations in the United States into one gigantic institution are in many respects the finest exemplifications of business skill this generation has seen, and as it is likely that in the history of the world no such colossal and intricate financiering has occurred as some of the achievements of the last half of the present century, it is fair to assume that this organization stands unrivaled in the history of financiering, unless one were to except, perhaps, the Standard Oil combination and one or two railroad consolidations.

The acting manager of the Western Union, General Eckert, is one of those men who are great enough to be modest. On Broadway or Wall street the eye of a stranger might be fixed upon him for a moment as a man who had learned the art of dressing well without being conspicuous, and one of those who was able to pass through the hustling throng that gathers in the money center at midday without displaying any of that haste or rush or anxiety which characterizes Wall street. If this stranger should happen to meet him and enter into conversation with him he would find a man of gentle manners, quiet speech and unobtrusive personality and would be likely to be amazed if told that this man carries the colossal part of the Western Union company in his head, so to speak, and had made of it so perfect a machine that it obeyed his will as easily as a Morse instrument responds to the touch of an operator's key.

General Eckert is of Ohio birth, and he was just old enough at the time when Morse gave his instrument to the world to be one of the first who mastered it. He not only mastered it, but he loved it, and he was soon recognized as one of the ablest operators in the West. That meant promotion, of course. He was put in charge of an office, and afterward became the general superintendent of the company which operated the telegraph along the line of that railroad which is now called the Pan Handle, running from Pittsburg to Cincinnati. In 1859 he made the acquaintance of Anson Stager and J. B. Layng, all three of them afterward to become famous and influential. Mr. Layng was the general manager of this railroad and Stager was an expert electrician. They were young men and they had their careers to make, and made them conspicuously afterward. When the war broke out Eckert became an associate of Charles A. Dana in the War Department, where he organized and had charge of the important telegraphic service of the army, and perhaps it was here that his extraordinary executive capacity first attracted the greater capitalists of the East.

# CORRESPONDENCE.

## New York Notes.

NEW YORK, December 14.—At this week's meeting of the Rapid Transit Commissioners the board devoted itself principally to the consideration of proposed changes in the location of express and local stations on the proposed lines. No definite action was taken.

The property of the Long Island Traction company was sold at public auction yesterday for $5,500,000. Only one bid was made. The property was knocked down to John G. Jenkins, president of the First National Bank of Brooklyn. Mr. Jenkins is understood to have acted in the interests of the reorganization committee. He presented a certified check for $10,000 before making the bid. To add to the confused street railway situation in Brooklyn comes the announcement from Albany that a new corporation—the Brooklyn Bridge, Prospect Park & Eastern Railroad company—has been incorporated, to construct and operate a street surface railway in Brooklyn, about 40 miles long. The capital is to be $500,000, divided into 5,000 shares; the principal offices are in Brooklyn, and the directors are A. N. Brady of Albany; Frederick S. Flower, Edward Browne, Ira A. Place, William J. K. Kenney, Charles H. Warner, George M. Curtis, Jr., and Walter H. Curtis of New York city, and John R. Petitt of Brooklyn. Commenting on the organization of the new company, the *Tribune* says:

Mr. Brady is a member of the reorganization committee of the Long Island Traction company. Mr. Flower is a nephew of ex-Governor Flower, of that committee, and these facts lead to the belief that the interests of that company and the new one are largely identical, and that the Brooklyn Bridge, Prospect Park & Eastern Railroad company may be controlled by the Long Island Traction company for the purpose of securing extension of routes and fighting P. H. Flynn and his syndicate. Moreover, "Blue-eyed Billy" Sheehan belongs to the law firm of Collins & Sheehan (Mr. Flower's private counsel) and is the counsel for the new company, and the routes proposed by it are practically identical with those asked for by the Flynn company, although there are expedient variations. Indications point to a fact which the *Tribune* published some time ago: That the Flynn syndicate and the Brooklyn Heights people are using every endeavor to kill each other, the fight being opened by the aggressive Mr. Flynn, and the Brooklyn Heights company scorning to make concessions, and retaliating in kind. It is rather difficult to get at the exact truth amid the kaleidoscopic applications for franchises recently made, and the officers of the companies are shrewdly non-communicative. Meanwhile Brooklyn property owners and those citizens opposed to the trolley have something new to think over every day. With so many comprehensive applications pending, and with nobody knows how many more coming, with the old Board of Aldermen still pondering, and a new board waiting to take its place, things are "slightly mixed."

President Rossiter of the Brooklyn Heights company says that his company is endeavoring to comply with the speed requirements of the municipal authorities, and is fitting cars with fenders at the rate of 15 a day.

The Western Union report for the last quarter of the year was issued on Wednesday. These figures are taken from it:

| | | |
|---|---|---|
| Surplus October 1st | | $7,854,622 99 |
| The net revenues of the quarter ending December 31st, instant, based upon nearly completed returns for October, partial returns for November, and estimating the business for December, will be about | | 1,700,000 00 |
| | | $9,554,622 99 |
| From which appropriating for— | | |
| Interest on bonds | $223,550 00 | |
| Sinking funds | 20,000 00 | |
| | | 243,550 00 |
| | | $9,311,072 99 |
| It requires for a dividend of 1¼ per cent. on capital stock issued about | | 1,191,945 00 |
| Deducting which leaves a surplus, after paying dividend, of | | $8,119,127 99 |

There has been some delay in the completion of the cars which are to be used on the new trolley postal routes in Brooklyn, and hence it was impossible to get the new service in operation at the beginning of December, as it was expected. No date has yet been set, but it is now believed by Postmaster Sullivan that the cars will be in operation next week, though it is possible that some further delays will occur. The cars, of which there are to be five, are being built in Philadelphia, and those which are completed were inspected recently by postoffice officials and found to be satisfactory. W. F. O.

## Washington, D. C.

WASHINGTON, December 13.—B. H. Ridgely, United States consul, in a recent report to the Department of State dated Geneva, November 19, 1895, calls attention to the approaching Swiss National Exhibition, which will be inaugurated at Geneva on the first day of May, 1896. Special prominence will be given to electrical appli-

ances. All the principal manufacturers in Switzerland have taken space, and are sparing neither pains nor expense to make the general display worthy of the country. In the electrical department some of the exhibitors have already taken space, but have not declared the full nature of their exhibits. There will be a traveling foot-path operated by electricity which will traverse the whole length of the great machinery hall. A force equal to 12,000 horse power is at the disposal of the exhibition authorities. This power is derived from the river Rhone. Duplicates of the turbines and other water power motors of the Rhone, the inventions of Theodore Turrettini, who is the mayor of Geneva, will have an important place. Electric carriages, a multiplying valve pump, and appliances for aerial navigation, will be shown, together with all processes (with the machines at work) employed in the production of paper, silk, cotton goods, etc., with electricity as the motive power. Methods of applying electricity for testing strength and qualities of all metals and materials will be shown by one of the principal Swiss scientists. Swiss residents of the United States are competent to exhibit, and the president, Theodore Turrettini, is anxious that they should be represented. President Turrettini is one of the most distinguished of European engineers and inventors, and he is taking great personal interest in the exposition.

John R. Galloway, the dealer in electrical supplies at 529 Tenth street, has the contract for wiring the Columbia Athletic club. Mr. Galloway has also recently presented to the St. Vincent's Orphans' Fair incandescent and miniature lamps and the necessary wiring.

A temporary injunction and a rule to show cause, returnable December 20, 1895, why the commissioners should issue to the Potomac Light & Power company a permit for the laying of a conduit on M street or any other street, were ordered this week by Chief Justice Bingham. The order was the result of a bill for such an injunction brought by the United States Electric Lighting company against the District and the Potomac company. Several days ago the commissioners ordered this permit issued. The Electric Lighting company claims prior rights in the matter, which, it is claimed, would be interfered with were such a permit issued and work allowed to be done. The company alleges that such a granting would be illegal. It is desired that the Potomac Light & Power company be temporarily enjoined from applying for or receiving a permit for a conduit on M street or any other street. The United States company wants the commissioners to disclose what permits they have issued, and if any, what work has been done, and by what authority they have acted. Information is asked as to whether the commissioners were advised in the matter by the attorney for the District. The United States Electric Lighting company claims that by permission of certain acts of Congress, set forth in the bill they have filed, that it is the only company authorized to lay conduits in the district.

The Metropolitan Railway company, through its attorney, E. P. Fish, has filed answer to the complaint made by Elias E. Ries and Robert H. Henderson, in the suit filed for infringement of a patent in the use of certain underground devices and improvements in its underground electric system. The company asserts that the alleged patents claimed by Ries and Henderson were of no effect, and that the devices designated were in use for more than two years prior to the several dates claimed for the application for the letters patent set up by the complainants.

The Potomac Electric Lighting company has secured a contract to light the streets of Cleveland Park with 24 or 25 candle power incandescent lamps. It is preparing to put some fine machinery in the old Dent foundry, Georgetown, and in a short time will have an extensive electric lighting plant. The machinery from the old Eckington power house will be transferred to Georgetown, the company having purchased it, and the current for Eckington will be furnished from Georgetown.

Senator Gallinger has introduced a resolution concerning the system of overhead wires. The resolution relates that by act of July, 1888, the commissioners were authorized to permit no additional telegraph, telephone or electric lighting or any other wires to be erected over any of the streets or avenues of the city of Washington, and by act of March 2, 1895, directed them, not later than the expiration of the Fifty-first Congress, to authorize such existing overhead wires to be placed underground. It also relates that a number of companies having overhead wires removed them and placed them underground; that the report of the electric commission, appointed October, 1891, was still unacted on by Congress. It further relates that the commissioners have been granted the right to permit existing companies to extend their lines, and that the evident intention of Congress is to prevent the further erection of overhead wires in the District, and placing all electric wires underground. It therefore calls on the commissioners to report to the Senate the permits that have been issued for overhead wires since September 15, 1888, to whom granted and under what authority. Also whether under the act of 1891 permits have been granted for placing any conduits or subways for electric wire which were not an addition to or extension of a previously existing law. If so, the name of the persons or corporations, and what work has been done by them. The resolution further provides that, pending the report called for, the District commissioners are requested to issue no further permits for the erection of any overhead wires in the District, and if such permits have been issued, to remove them. Also that no further electric conduits or subways in the District shall be built pending action by Congress.

Some enterprising Americans have made application in the city of Honolulu for permission to build a trolley road, and F. S. Dodge, the city engineer, called at the District building recently to look into the street railway franchises of this country. T. M.

## PERSONAL.

S. B. Condit, Jr., manager for L. A. Chase & Co. of Boston, was in Chicago on Monday.

John Kruesi, mechanical engineer, and W. L. R. Emmett, engineer of the lighting department of the General Electric company, Schenectady, paid a visit to Chicago last week.

The board of trustees of the University of Illinois has made two important promotions. William Esty has been raised from the position of instructor in electrical engineering to that of assistant professor, and Mr. Sager, who has been instructor in physics for the last year, was made assistant professor in that department.

Mrs. Emeline Westinghouse, widow of the late George Westinghouse, Sr., died in New York recently at the age of 86 years. In 1828 she was married to George Westinghouse, Sr., an inventor, who afterward became the proprietor of the Schenectady Agricultural Works, at Schenectady, N. Y., and who died on December 30, 1884, when 75 years old. She was the mother of 10 children, of whom only two survive—George Westinghouse, Jr., inventor of the Westinghouse air brake and president of the Westinghouse Air Brake company and the Westinghouse Electric & Manufacturing company, and Herman H. Westinghouse, inventor of the Westinghouse engine and general manager of the Westinghouse Air Brake company. Mrs. Westinghouse was of pronounced character, but of kindly and benevolent disposition and greatly beloved.

## ELECTRIC LIGHTING.

The town of Camden, Maine, after being in darkness for 18 months, was again brilliantly illuminated on the 9th of December, much to the delight of the citizens, the ladies being especially jubilant. Manager Hawken, of the Knox Gas & Electric company, has rebuilt the whole pole line and put in 23 Brush double arc lamps.

## ELECTRIC RAILWAYS.

A mortgage was filed in the recorder's office at Chicago on December 11th by which the North Side Electric Street Railway company secured a loan of $1,500,000 from the Illinois Trust and Savings Bank. It is said the money was borrowed to complete its plant as proposed by the board of directors.

Judge Baker of Indianapolis has closed up the papers by which the sale is effected of the South Bend and Mishawaka electric railroad to George E. Clifford, president of the Wachusett National Bank of Richfield, Mass. The price paid was $50,000. It is the intention of Mr. Clifford to put the road in fine order.

A Baltimore paper reports that electric locomotive No. 2 of the Baltimore & Ohio tunnel line has successfully withstood severe tests. The new engine hauled 28 loaded cars, two "dead" engines and a caboose, a total weight of about 1,400 tons, through the tunnel at the rate of about 23 miles an hour. The train entered the tunnel at a speed of 20 miles an hour. A stop was made in the tunnel, and with all drawbars stretched the start was again made without a slip of the wheel. In doing this and accelearting the train up to the speed of 23 miles an hour a draw-bar pull of 58,630 pounds was exerted. With this tremendous strain the engineers say the least jerk would have snapped a coupling-pin and broken the train apart. From one of the locomotives on the rear end of the train, where a jerky motion would be felt the greatest, an entire absence of such a jar was noted. During the work an imput of 4,100 amperes at a pressure of 600 volts was measured. The test is regarded as the severest yet attempted by such a locomotive. No. 3, which will complete the number of locomotives for the Belt Line service, is now approaching completion at Schenectady and will be brought to Baltimore about January 1st.

## MISCELLANEOUS.

In relation to the affairs of the Lodge & Davis Machine Tool company, a Cincinnati newspaper states that the motion for a confirmation of the referee's report and a sale of the assets is before Judge Moore. Thos. McDougall, for the company, filed a motion to strike from the files the motion to confirm for a receiver and a sale of the assets.

## TRADE NEWS.

One of the largest dealers in telegraph and street railway poles is A. Bushnell of Kansas City, Mo. Since July last he has sold over 1,500 cypress poles to street railway and electric light companies, and is constantly rushed with orders for cypress piling of unusual lengths, which he is able to supply on short notice. Mr. Bushnell has done a flourishing business ever since he commenced in 1886.

Thos. G. Oakes, who for many years has been manager of the sales department of the Jenkins Valve company of New York, has resigned his position to accept a flattering offer from the Mason Regulator company of Boston, Mass., to take charge of its office, located at 52 John street, New York, where he will handle a line of Mason steam pumps, damper regulators, pump receivers and steam traps. Mr. Oakes has an extensive and valuable acquaintance in the electrical trade, and his friends will be glad to hear of his success.

The Gates Electric Manufacturing company of Chicago has recently installed a 75 horse power, 500 revolution motor in the works of Fraser & Chalmers, Chicago, for the operation of a large Root blower at the cupola. John Walker, manager of Fraser & Chalmers, in a recent letter to a large concern contemplating the installation of a similar outfit, stated that they had received a machine with more capacity and efficiency than contracted for. He said that this motor, both as to construction and electrical requirements, is the best that his company knows of. The Gates company also reports an active trade in electrical apparatus for mines, street railways and lighting plants.

At the annual meeting of the board of directors of the Phœnix Carbon Manufacturing company of St. Louis, held on December 10th, it was unanimously decided, in view of the increase of business and the flattering outlook in all of the various departments, to increase the capital stock to $250,000. The Phœnix company is incorporated under the laws of Missouri for $100,000, fully paid up, and as there is a stringent anti-trust law in that state, it will be seen that the increase of $150,000 in capital stock means a good, straightforward and growing business. This is, incidentally, a high tribute to the ability of Superintendent S. G. Booker, whose energy and keen business judgment have been unremittingly exercised for the benefit of the company. The growth of the business has been exceptional, and as the increase of capitalization will be paid in at once and used for the extension and enlargement of the present plant, it will be seen that the facilities of the company will be made adequate to the growing demand tor Phœnix carbons. The Phœnix company is certainly entitled to congratulations.

## BUSINESS.

The Mica Insulator company of New York has purchased the entire business of the Empire Electric Insulation company of Schenectady, N. Y., manufacturer of oil insulating cloth and paper, and will continue the business in connection with the manufacture of micanite specialties.

A very creditable catalogue of electric light supplies is issued by the E. P. Gleason Manufacturing company of 181–189 Mercer street, New York. The book has 210 pages and flexible covers, and is completely illustrated and well printed. It is particularly complete in glass goods and fixtures, but covers all lighting supplies and will be a valuable aid to the buyer.

The improved Hunnings telephone and telephone switchboard, manufactured by the Electric Appliance company, continues to hold its ground as one of the most satisfactory outfits on the market. The telephone itself has been improved from time to time until it is now said to be a perfect instrument. The switchboard is a winner, and is operated more easily and with a less number of movements, it is claimed, than the regular Bell board.

President H. G. Ferguson of the International Electric company, St. Louis, visited Chicago last week in the interest of his company. The International Electric company is at present actively engaged in pushing the Davey high grade incandescent lamp, and Mr. Ferguson states that the prospects are most encouraging. It is not unlikely that the International company will establish a branch of its business in Chicago. Mr. Ferguson is an old electric light man, and is thoroughly familiar with the electrical business, having been in it for a number of years, and Mr. Davey, after whom the lamp is named, is well known among lamp manufacturers. With two such energetic men, each pushing his respective department, it is only reasonable to presume that the new company will rapidly bring its product into the foremost rank.

In November, 1894, the Ætna, Ind., Powder company decided to install two small slow-speed generators for operating incandescent lamps on the Edison three-wire system and placed the order with the General Electric company. As these could not be delivered immediately, two second-hand machines were installed temporarily, and before the first two new ones ordered could be delivered, the order was changed to two larger, moderate-speed generators, with the privilege of changing them for two still larger ones. In June, 1895, the last two were ordered, together with two motors, one of one horse power, the other of five horse power. On August 2d the Ætna company ordered another motor of five horse power, and on August 14th still another of the same capacity. The company having enlarged its plant during the summer found its electrical installation insufficient, and on October 12th ordered two 45 kilowatt moderate-speed generators and two moderate-speed motors, one of 20 horse power, the other of 30 horse power. Thus within one year electricity had given the Powder company such satisfaction that it now has 66 horse power in motors and 93 incandescent lamps taking current from the two 45 kilowatt generators. The one horse power and the five horse power motors are used to drive small mixing machines in the manufacture of dynamite. The 30 horse power motor operates a large machine used for pulverizing nitrate of soda, and the 20 horse power runs a number of machines, such as the dry pan and mixing machines. The Powder company found that the first five horse power motor, which it substituted for a steam engine, readily performed a duty which the engine found difficult.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued December 10, 1895.*

550,950. Paper Registering Machine. Talbot C. Dexter, Pearl River, N. Y. Application filed October 26, 1894.

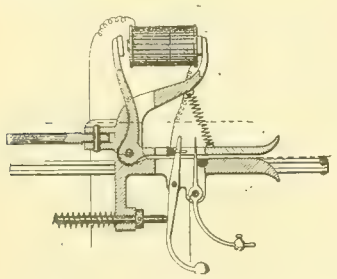
The cut shows a reciprocating gripper, having its jaws held normally in an open position, an electro-magnet closing these jaws by the attraction of its armature a normally open electric circuit and a circuit closer in the path of the paper to be actuated thereby.

550,956. Carbon Holder for Arc Lamps. Hugh J. Farley, Philadelphia, Pa. Application filed December 15, 1894.

A removable casing is formed in separable sections, the body portion having an interior flange threaded to receive the outer casing, which is formed in two parts with a spherical cavity to receive the rod of the lamp, and a ring nut having a series of spring fingers adapted to be secured to the lower end of the body of the holder.

550,959. Electric Clock. Benjamin Franklin, Chicago, Ill. Application filed April 1, 1893.

The impulse-producing mechanism is arranged to be set by electrical action.



NO. 550,950.

550,965. Electrical Conduit Railway. John D. Griffen, New York, N. Y. Application filed December 5, 1892.

The conduit has the usual slot, the trolley wire and the trolley arm, a carriage for the trolley arm with rollers adapted to engage the sides of the slot. There are also ball boxes in which the rollers are journaled, and which are provided with hubs and springs engaging the hubs and acting to hold the rollers in contact with the sides of the slot with a yielding pressure.

551,014. Electric Smelting Furnace. Joseph A. Vincent, Philadelphia, Pa. Application filed July 18, 1895.

There is described a substantially horizontal channelway for supporting the material to be smelted, two electrodes of different polarity arranged transversely to the channelway, a positively acting feeding device arranged to force the material to be treated into the channelway at one end and between the electrodes, and a discharging pit arranged at the opposite end of the channelway and opening into it.

551,020. Electro-magnet. Samuel T. Wellman, Upland, Pa. Application filed April 18, 1894.

The top plate, two poles of the magnet secured thereto, wrappings of wire for each pole, a bottom plate through which the cores extend, and a shell mounted between the top and bottom plates and surrounding the wrappings of the magnet are features claimed.

551,021. Electric Rail Bond. William H. Wiggin, Worcester, Mass. Application filed May 22, 1895.

The first claim follows: An electric rail bond comprising a bond wire or rod and four loose sleeves or collars, two at each end thereof, each set of said sleeves or collars consisting of an outer sleeve or collar, having a tapered hole converging in the direction toward the body of the bond wire or rod, and an outwardly projecting annular flange or rim at the opposite end from said bond wire or rod adapted to fit against the rail flange when the sleeve or collar is fitted in the opening in said rail flange, and an inner sleeve or collar having a straight opening adapted to fit the end of the bond wire or rod, and made taper-shaped upon the outside corresponding to and fitting in the tapered opening of the outer sleeve or collar, with the transverse outside diameter of the inner sleeve or collar a trifle larger than the opening in the outer sleeve or collar.

551,029. Electric Arc Lamp. William J. Davy, London, Eng. Application filed April 19, 1895.

The carbon holders are connected together by a flexible connection passing over a pulley and the carbons tend to approach; the friction grip device consists of two parallel nipping surfaces moving with the pulley, a nipping lever having a notch fitting loosely on the nipping surfaces and pivoted parallel to the nipping surfaces, a means for determining the position of the lever pivot according to the resistance of the arc and of a stop on which the notched end of the lever rests.

551,032. Cleat for Electric Wiring. James R. Hemphill, Akron, O. Application filed September 26, 1895.

The device is formed in one piece, and has a wire receiving recess tapered or reduced in width toward its inner end, and curved or pitched downwardly.

551,033. Commutator Brush. Robert Hirsch and Herman Meminger, Milwaukee, Wis. Application filed January 28, 1893.

It is composed of alternating sections or strips of a lubricating and scouring composition, and of metal inclined or offset to the plane of rotation of the commutator, so as to produce a continuous and approximately uniform area of metallic contact to the commutator in the direction of the width of the brush.

551,046. Electric Arc Lamp. Frederick N. Pike, New York, N. Y. Application filed June 27, 1894.

An arm comprising a longitudinal portion and a transversely extending portion, a carbon support secured to the transversely extending portion, a carbon support movable lengthwise of the longitudinal portion of the arm, a screw engaging with a nut supported by the second carbon support, ratchet wheels secured to the end portion of the screw, solenoids whose cores are provided with pawls for actuating the ratchet wheels, and means for producing a vibratory movement of the cores to actuate the screw.

551,053. Electric Controller. Sidney H. Short, Cleveland, O. Application filed August 26, 1895.

The combination is claimed with a series of rotary contacts made of magnetic material, and a series of magnet poles arranged with relation to the contacts, whereby a complete magnet circuit comprises two of the magnet poles and two of the contacts, and contact fingers having their free ends located within the magnetic fields thus produced.

551,054. Electric Controller. Sidney H. Short, Cleveland, O. Application filed August 27, 1895.

One claim is for the combination with rotary contacts of magnetic material and a series of contact fingers, of an electric magnet having a series of pole-pieces terminating in proximity to the contacts, each pole-piece being slotted for the reception of the free end of a contact finger.

551,056. Multiple Switchboard System. Theodore Spencer, Cambridge, and Thomas C. Wales, Jr., Boston, Mass. Application filed March 18, 1895.

Features specified are: Two telephone circuits, each extending from a sub-station to the same central station, and completed or closed through a section of conductor common to both, which includes an electrical generator and four repeating induction coil windings interposed respectively between the two poles of the generator, and the conductors of the circuits having two of the four windings included in each of the two circuits in inductive relation to the other two windings.

551,060. Telephone Circuit. John S. Stone, Boston, Mass. Application filed July 6, 1895.

In a centralized battery telephone system, the combination with two main line conductors extending to a sub-station, forming severally the two conductors of a metallic talking circuit connected in parallel with one another to constitute the single main line conductor of a supply circuit having a ground or independent return conductor, and containing the main source of current supply, of a retardation or impedance coil having its two ends united to the two sub-station ends of the the main conductors, and its middle to their common earth terminal or return conductor, the sub-station transmitter connected in the terminal conductor, and two electrolytic or polarization batteries connected in independent shunt circuits extending from different sides of the transmitter to the two main conductors respectively.

551,090. Signaling Apparatus. Bernice J. Noyes, Boston, Mass. Application filed September 11, 1889.

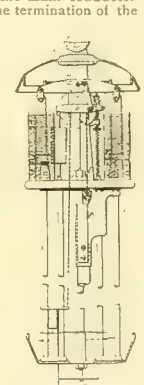
A multiple signal transmitter, a pointer and switch moved by the pointer, and a retarding device which is operatively connected therewith in certain positions only are combined with a signal receiving apparatus connected with the multiple signal transmitter by an electric circuit, the signal receiving apparatus comprising a register and a bell.

551,123. Successive Non-interfering Signal Box. William H. Kirnan, Brooklyn, N. Y. Application filed August 18, 1890.

A circuit controller, a normally wound motor therefor, a releasing device for the motor, a magnet in the signal circuit at the transmitter, a normal short-circuit for the magnet, and a circuit breaker operated by the first movement of the transmitter are the features.

551,145. Switch for Underground Electric Railways. Alfred Rosenholz, San Francisco, Cal. Application filed April 12, 1895.

The invention consists of a stationary magnetic core projecting from the main conductor, a sealed casing therefor, fulcrumed and turnable in journals or bearings about the main conductor, a flexible insulating sheath or jacket surrounding the junction of the main conductor and core, and a ring and groove joint at the termination of the sheath within the casing.



NO. 551,020.

551,166. Joint for Insulated Electric Wires. Raymond S. Kelsch, Chicago, Ill. Application filed December 22, 1894.

An externally threaded sleeve is provided with a jam nut and a sleeve provided with a swiveled nut to receive the externally threaded sleeve and be engaged by the jam nut to clamp the parts securely together, the sleeves having flaring openings through them to receive and hold in contact the flared and jointed ends of conductor sections, and an envelope for the coupling, comprising separable box members, with means for securing them together, affording a chamber for insulating material and fitting at its ends the conductor sections.

551,168. Trolley. David Lippy, Ira E. Finfrock, George A. Rinehart and David R. Francis, Mansfield, O. Application filed September 24, 1895.

The pivoted mast, the spring device for swinging the mast upward, a chain connecting such device and the mast, and a roller on the mast pivot in the path of the chain when the mast is swung down.

551,169. Trolley. David Lippy, Ira E. Finfrock, George A. Rinehart and David R. Francis, Mansfield, O. Application filed September 24, 1895.

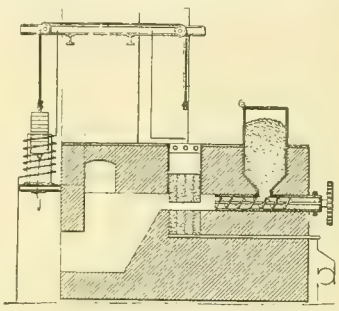
The combination is claimed of the pivoted mast, a shaft having two radial arms connected with the mast, and a coiled spring for rotating the shaft.

551,170. Switch for Electric Plants. Austin H. Lucas, Pittsburg, Pa. Application filed January 4, 1895.

This arrangement comprises a series of pairs of contacts adapted to be connected to a like series of generators, a second series of pairs of contacts arranged parallel with the first series, a shaft or rod arranged parallel with the series of contacts and provided with a longitudinal groove and with a series of transverse grooves, a pair of arms having one end mounted on the shaft or rod, and each having a pin or key adapted to fit the grooves, the transverse grooves being so arranged as to permit of a rotation of the arms on the shaft only when the arms are in line with a pair of contacts.

551,192. Telegraph Relay. Archibald D. MacDonald, Melbourne, Victoria. Application filed November 2, 1894.

When at a state of rest a horizontally arranged pivoted armature lever is adapted to oscillate vertically between cores, placed one above another, the lever being fulcrumed on one side of the cores, and having on the other side contact points and a tension spring, the latter vertically set above the end of the lever, and on the other side of the fulcrum an arm or extension of such weight as to act as a counterpoise to the first named side of the lever and allow the latter to rise up against the back stop when the spring is regulated to exert an upward pull.



NO. 551,014.

551,203. Electric Switch. John E. Criggal, Springfield, Mass. Application filed January 15, 1895.

There is described the combination with a supporting base of a pole piece having a contact face substantially in the path of movement of the circuit controller, a circuit controller having a reactive connection with the base, and movable with the actuating lever, and transversely resilient toward the contact face of the pole piece, and having its contact face movable substantially in the plane of the contact face of the pole-piece, and an actuating lever pivoted on the base for closing the circuit controller, and normally holding the circuit controller against free, reactive movement, and also adapted to release the same at a predetermined point in the backward movement of the actuating lever, whereby the circuit controller has a sudden and multiplied releasing movement in the direction and independently of such movement of the actuating lever.

551,244. Electric Arc Lamp. William P. Wiemann, Washington, Pa. Application filed April 17, 1895.

In an arc lamp, the combination with the rod controlling mechanism of a releasing point therefor, and means for automatically changing its position as the carbon decreases in weight.

551,263. Anti-sparkle Commutator Compound. John R. Davis, New Iberia, La. Application filed March 30, 1895.

The compound is composed of a fatty substance, a good conductor of electricity mixed with the substance, and chalk to harden the mixture.

551,275. Telephone Transmitter. John Goodman and Henry M. Goodman, Louisville, Ky. Application filed June 14, 1895.

A telephone transmitter is described, consisting essentially of two magnets, the one fixed or relatively so, and the other capable of vibration, the magnets being so collocated and mechanically adjusted that the movable magnet in its vibrations at all times remains equi-distant from the adjacent parts of the stationary magnet, a vibrating diaphragm to which the vibratory magnet is mechanically connected or related, and finely comminuted magnetic material between the two magnets in the magnetic field formed thereby.

551,284. Electric Sunshine Annunciator. Leonard Hunt and Frederick W. Duenckel, St. Louis, Mo. Application filed May 20, 1895.

An electric sunshine annunciator, comprising a suitable base, a pair of uprights mounted upon the base, a pair of balanced bulbs, one on each side of the uprights, tubes connecting the lower ends of the bulbs, a screw-threaded rod fixed to and extending from one bulb to the other, a weight adapted to move upon the screw-threaded rod, an arm extending horizontally from one of the bulbs, an inverted U-shaped metallic wire carried by the arm, and cups adapted to contain mercury located directly beneath the metallic wire, with which the wires from the recording apparatus terminate.

551,334. Electric Railway. Robert Lundell, Brooklyn, N. Y. Application filed June 9, 1894.

Claim 1 reads: In an electric railway a current feeder or main, two sets of sectional trolley conductors arranged in pairs, normally open branch feeders running from the current feeder or main to switches controlled by electro-magnets, circuit connections from one of each pair of sectional trolley conductors through two of the switch operating electro-magnets in series and from the other trolley conductor of each pair to one of said magnets.

551,337. Electrode for Arc Lamps. Thomas G. Portis, St. Louis, Mo. Application filed May 14, 1895.

A pair of electrodes of an arc lamp having their arc ends lightly coated and their outer ends heavily coated.

551,347. Telephone Receiver. Alfred C. Brown, London, Eng. Application filed July 11, 1895.

The combination includes a battery transmitter, a telephone receiver having a diaphragm and buzzer contact to be operated by the diaphragm, a battery, and a switch for closing the connection of the battery through the transmitter or through the buzzer contacts and a coil of the receiver at will.

Western Electrician.

EVERY SATURDAY.

Vol. XVII. CHICAGO, DECEMBER 28, 1895. No. 26

## Use of Static Electricity in a Bottle-labeling Machine.

The machine shown in the illustration on this page and diagrammatically represented in Fig. 2 possesses much interest from the fact that the inventors have attempted to make use of static electricity to attract, one by one, the paper labels pasted on bottles in a labeling machine. A successful bottle-labeling machine would immediately be in wide demand in breweries and other bottling establishments, as it would result in a great saving in labor. One great difficulty that has been met in designing machines of this character is to devise a mechanism that will detach the top label from a pile, so that it may be subjected to the action of a paste roller and afterward attached to the bottle. In the machine under consideration this operation is accomplished by the statically-charged plunger of a solenoid. In practice it is found that the regulation of the slight impulse of static electricity required is a matter of considerable delicacy, as it is, of course, necessary to have each successive charge of the plunger of that polarity which will attract the top sheet of paper rather than repel it. An ordinary glass friction machine is used to produce the static electricity, while the dynamo shown furnishes current to energize the various solenoid coils. In the photographic reproduction the machine is shown as it would appear in labeling beer bottles, although the main driving belt is not attached.

A good idea of the mechanism can be obtained by Fig. 2, which is a reproduction of a central section drawing showing the machine at the extreme outward end of stroke. The traveling paste roller $F^1$ is taking paste by friction from the stationary paste roller below, the latter being driven by a belt from a sheave on the main shaft. A bottle has dropped through the rotary bottle gate $H^1$ and is resting on the rubber-lined table or machine bed; a label is shown lifted from the pile by means of a static electric current and the solenoid $D^1$, which at this time is energized.

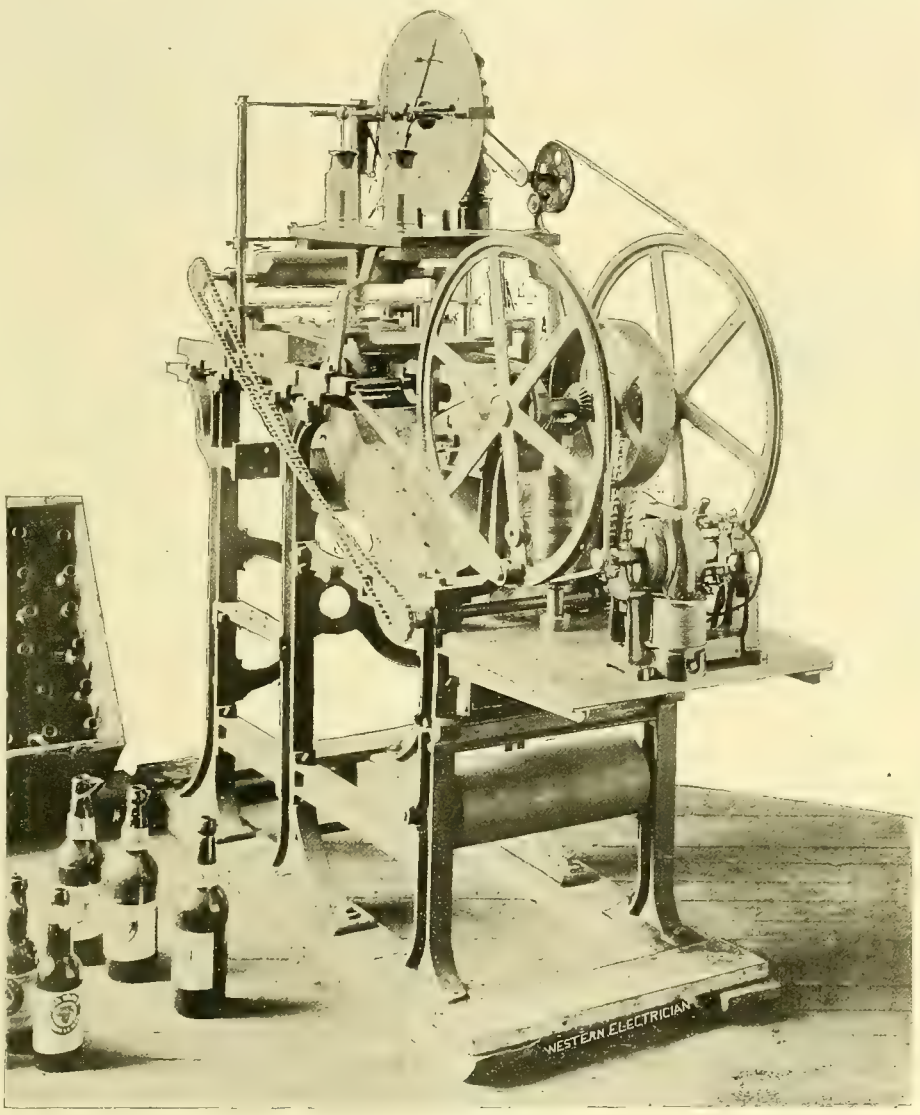



FIG. 1. USE OF STATIC ELECTRICITY IN A BOTTLE-LABELING MACHINE.—GENERAL APPEARANCE OF MACHINE.

The machine in this position, the operation is thus described:

The solenoid $D$ is energized, reciprocating the core $d$ downward so as to approach one side of the top label in the label-box or holder, being the side opposite to the cleat or shoulder $b^1$. The plate $C^2$ at this time is understood to be at its extreme limit of stroke to the left. The ends of the plunger or core are charged with electricity, and, according to the well-known law, the top label is thereby attracted or lifted up at one side by the plunger or core, after which the solenoids $C$ are energized and the plate $C^3$ caused to advance underneath the label thus attracted, thereby separating the top label from the second and the pile of those immediately beneath. The lifting of the label is clearly shown in Fig. 2, in which the relative position of parts is illustrated just previous to the reciprocation of the slide-plate to the right between the top and the second label. This reciprocation of the plate is the next movement in the sequence of operations of the machine.

A horizontal frame $E$ is mounted upon the machine bed or frame and is provided with horizontal guide-ways $E^1$. This guide-frame is designed to permit of the reciprocation of a cross-head carrying a paste roll and a device for rolling or pressing the bottles over the labels. This cross-head consists of a frame adapted to slide in the channels or ways of the frame $E$. The bottle-rolling and engaging device consists of a horizontal plate $F$, which is termed a pressure plate, arranged above these guides and pivotally connected thereto by means of links $f$ $f^1$, whereby it may have both a swinging and a reciprocating motion. The links $f^1$ are somewhat longer than the links $f$ and are extended below the point of connection with the cross-head frame, where they are provided with suitable bearings to receive the gudgeons or short shafts of the traveling paste roller $F^1$.

At the right-hand of the machine is mounted the driving mechanism, consisting of suitably journaled pulleys $G$ $G^1$ rotated by means of the belt $G^2$ connected to a desired source of power. These pulleys operate other pulleys and sprocket wheels which are necessary to drive and actuate the various mechanisms of the machine.

The paste roller $F^1$ is actuated by means of the crank arms $f^2$ connected respectively to the crank pins $f^3$ on the drive wheels or pulleys $G$ $G^1$ and to the shaft of the roller below the pivotal point of the link $f^1$. Within a suitable paste box or receptacle of the proper shape or dimensions is journaled a rotatable paste roller $F^2$, whose lower periphery dips into the paste at all times and whose function is to feed paste by its constant rotation to the other roller when brought into close proximity. As shown, motion is communicated to the roller $F^2$ by means of a belt running around a pulley on the main shaft.

At the extreme left of the machine is the bottle feed chute or incline $H$, which is supported at the required elevation. At the mouth or open end of this chute is a device which may be termed a bottle gate and which consists of a rotatable roller $H^1$ mounted in suitable bearings in upright standards $h$ secured to the machine frame. This roller is cut away partially, so that it is somewhat semi-circular in cross-section, to accommodate it to the particular article here to be labeled, that is, a bottle. It is obvious that when the full face of the gate is presented to the bottles pressing thereagainst by gravity, the bottles will be held in the chute, but that when the opposite face is presented a single bottle will be allowed to pass or fall through to the bed of the machine, to be operated upon by the label-attaching devices proper. It will be understood that the particular contour of the gate may be altered to suit circumstances and the character of the package or article to be labeled. The roller may be rotated by any suitable connection with the driving mechanism, as, for instance, by the sprocket chain running around a sprocket wheel and around the wheel $h^3$ driven by pulley $G^1$. The various pulley and sprocket wheels are so made that they will cause the mechanism which they control to operate at the proper predetermined times.

Forward of the label box is arranged the bottle delivery, which consists of an inclined chute $J$ leading from the machine bed downward to a horizontally traveling endless belt or apron $J^1$, forming a continuation of the delivery and adapted to carry the bottles to the place desired. At equidistant points along the apron are a series of upright fingers $j$, which are preferably covered with rubber or other cushioning material to separate the bottles, or to prevent their breakage by coming into contact with each other or by their descent in the inclined chute. As shown, the apron is operated by means of the pulley $K$, which is rotated by the sprocket wheel $K^2$, receiving its motion from the sprocket wheel $k^1$ on the shaft $k^3$.

The pressure plate is provided with a series of removable plates or strips, the middle plate being shown removed to allow the plunger or core to pass therethrough. The object of these plates is to accommodate the different sizes and widths of labels used, as it is desirable that the plunger should approach the label at substantially the middle point of one side

or edge. To this end the position of the solenoid and plunger may be shifted and the plate or strip directly beneath the plunger may be removed as desired.

A dynamo $G^3$ is connected to one of the main drive-wheels or pulleys in order to supply the necessary current to operate the solenoids, although the current may, if desired, be derived from an independent source.

In all present label machines it is impossible to attach labels of different shapes without materially altering the machine or reconstructing it, but in this machine any shape of label may be equally provided for. For instance, take a diagonal or circular label, where the paste is liable to be smeared over the plate not covered by the label. In the electrical machine such a label can be readily provided for by attaching to the upper face or the slide-plate a thin supplemental plate having the same shape of contour as the label that is to be attached, so that the label alone will receive paste.

The bottle is first admitted from the feed chute through the gate and allowed to fall upon the bed of the machine. At this instant the plunger is reciprocated downward to approach the top label in the box, and simultaneously the earth connection of the static machine is broken by the rotating switch device, thereby charging the plunger with static electricity. The relative position of parts at this stage of the operation of the machine is shown in Fig. 2, in which the top label is seen to be attracted and held up by the plunger. Next, the circuit in which the solenoids *C C* are interposed is completed by the switch device, and the solenoids are

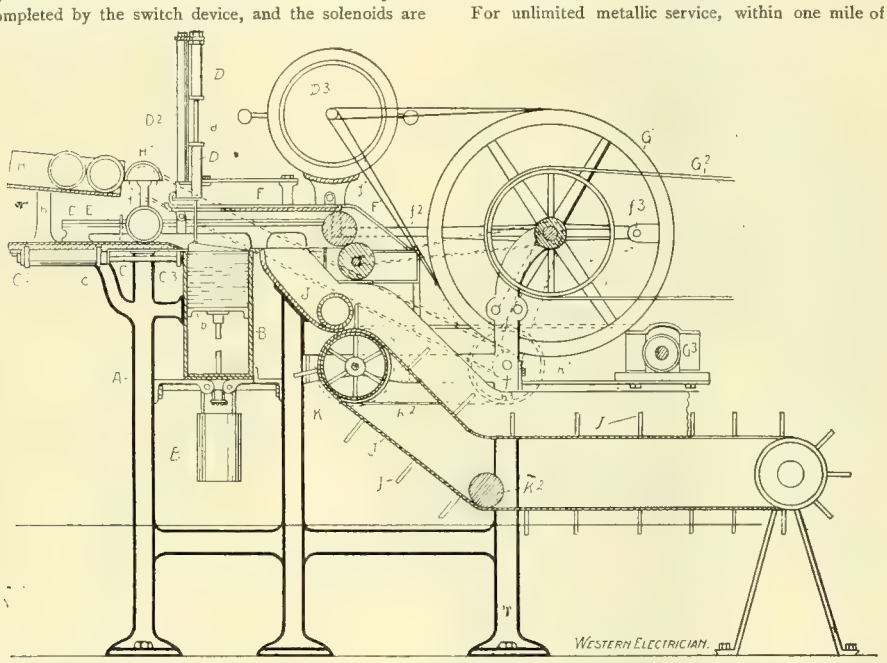



FIG. 2. USE OF STATIC ELECTRICITY IN A BOTTLE-LABELING MACHINE.—CENTRAL SECTION DRAWING.

energized, drawing in their cores and reciprocating the slide-plate beneath the label thus attracted or lifted. Immediately the traveling paste roller is caused to pass over the label and apply paste thereto. In the withdrawal of this roller, the pressure plate is caused to swing downward by reason of the peculiar manner of pivoting it upon links, in one set of which the paste roller is journaled. In thus swinging down, the frame engages the bottle, and in its reciprocation—being drawn to the left during the withdrawal of the paste roller—presses and rolls the bottle over the label. The bottle thus picks up the label, which is firmly pressed upon and attached to the bottle in the rolling operation to which it is subjected. On reaching the proper opening in the machine bed, the bottle falls downward into the delivery chute, from which it is carried to the place desired by the communicating delivery apron or carrier.

The diagram does not show the electrical circuits nor the construction of the rotatable circuit breaker, which is in the form of a cylinder having contact points or strips on its periphery whereby the solenoid circuits may be successively or alternately made and broken in order to reciprocate the cores so as to cause the various parts of the machine to operate at proper pre-determined intervals.

The machine may be run at 60 revolutions per minute, and it is estimated that it will label 36,000 bottles a day. It is in charge of J. Francis Small, Chicago, one of the inventors.

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Robert Gillham was allowed $12,500 by Judge Henry of Kansas City for his services as receiver of the Northwest electric railway during the 25 months ended October 1st. He was paid at the rate of $500 per month. Mr. Gillham's report shows the receipts of the road during that period to have been $94,611.22, and there is now $2,715.38 on deposit to the road's credit. During the last eight months 34,424.19 was collected in fares.

## Wisconsin Telephone Company.

[From the Milwaukee correspondent of the WESTERN ELECTRICIAN.]

As a result of the organized fight among its subscribers against the claims for extra calls, the Wisconsin Telephone company has made additional concessions, and the prospect of an amicable adjustment of all points in controversy is good. To the committee which represented the Telephone Users' association the company made a number of propositions in detail. The main proposition, however, was that that the subscriber to telephone service on the basis of the number of calls shall have the choice of a limit and rebates, or have a limit and pay for all calls in excess of it. In other words, subscribers on the basis of only 1,000 calls a year, and who pay $75 a year in rental, will receive a rebate of 7½ cents for each time that they are entitled to use the telephone and do not do so. The other part of the alternative is the privilege of using the telephone 1,200 times during the year and paying the company 2 cents a call for all calls in excess of that number,

The company divides its service into three classes: Limited metallic service, unlimited metallic service and unlimited grounded service. For limited metallic service, within one mile of the exchange, the charges proposed are as follows: For 500 service messages, $50 for one subscriber and $40 each for two subscribers on the same line; for 600 messages, $57 and $47; for 700 messages, $63 and $53; for 800 messages, $68 and $58; for 900 messages, $72 and $62; for 1,000 messages, $75 and $65.

For unlimited metallic service, within one mile of the exchange, the charges proposed are as follows: One subscriber with special line, $120; two parties on same line, $100 each; three parties on same line, $80 each; four parties on same line, $70. These rates are for business houses. For residences the rates for the same service run from $70 to $45, according to the number of subscribers on the circuit.

For unlimited grounded service, within three-fourths of a mile of an exchange, the business rates are as follows: One subscriber, with special circuit, $72; two subscribers on the same circuit, $66 each; three subscribers on the same circuit, $60 each. The rates for this service at residences are $50, $42 and $36 a year, according to whether one subscriber or two subscribers or three subscribers use the line. The charge per telephone for extra mileage is $10 for business houses and $7.50 for residences for every quarter of a mile in excess of the one-mile limit, and for grounded service the charge is $5 for each quarter of a mile in excess of the three-quarters of a mile limit.

It is understood that the company has since made some further concessions, but just what they are is not known. There is some talk to the effect that the grounded service will be discarded entirely and that more liberal provision will be made in regard to extra calls. Many people think that the company has acted in a very reasonable manner. In behalf of the company it is asserted that its net revenues never exceeded 8 per cent. upon the capital invested and that the annual dividend of the company during the last three years has been only 6 per cent. The new tariff which the company has offered to establish is said to be a reduction of 20 per cent. The company, of course, expects to make up its losses in this respect by a more general use of telephones. The company will probably satisfy its subscribers and thus put an end to the talk of an outside company entering the the Milwaukee field.

## Chicago's Storage Battery Road.

The officers of the Englewood & Chicago Electric Railway company, which will soon have a storage battery road in operation in the southern part of Chicago, report that satisfactory progress is being made, and that some of the cars will be in operation about April 1st.

The company has a franchise for 54 miles of road, and the line, when completed, will extend from the South Park avenue station of the Alley "L" at Sixty-third street and Vernon avenue, through Vernon avenue to Sixty-seventh street, to Vincennes avenue, to South Chicago avenue, to Keefe avenue, to Vincennes avenue, to Seventy-first street, to State street, to Seventy-ninth street, to Vincennes road, to Morgan Park. A portion of the line is already built and supplied with overhead electric equipment, but the new company will operate the whole system by the use of storage batteries on the cars. There will be 50 motor cars and 50 trailers. Each motor car will be equipped with an outfit of chloride accumulators weighing 4,500 pounds and placed on the trucks with two G. E. 800 25 horse power motors. General Electric controllers will also be used, and the same company's generators will be used in the power house, which has not yet been located. The power house engines and the car trucks have not been selected.

The claim is made that in seven minutes the cells can be charged sufficiently to run a car 40 miles. This seems surprising, but the statement is confidently made. By means of little tramcars and elevator platforms the discharged battery can be taken from a car and replaced with a freshly charged equipment in the space of three minutes, it is said. The workmen will have no need to touch the boxes containing the cells. The cars may be operated up to a maximum speed of 25 miles an hour.

The company has opened an office at 813 and 814 Marquette building. Its officers are: President, J. C. Shaffer; vice-president, Judge Old; secretary, C. F. Griffin. In conversation with a representative of the WESTERN ELECTRICIAN, President Shaffer said: "We purpose to demonstrate that a storage battery road can be operated as well, physically, as an overhead trolley electric equipment, and better than a trolley road from a financial point of view. This may seem like undertaking a large contract, but I think that we will be successful and that Chicago will have the first practical storage battery railway in the country—one that, in operation, will attract the attention of street railway men and the public the whole country over. People are prejudiced against the storage battery for traction, but I think we will be able to remove that prejudice. Litigation has very greatly retarded the development of the storage battery, but with one company owning all the patents, and able to embody the best features of all in one cell, we will be able to show what the storage battery can do. We will equip our Chicago road as a model and an example. Everything will be first-class, and we look to the future with confident anticipation of success."

The specifications for track construction are about to be issued.

## Fire Balls Lighted the Ship.

[From the *Philadelphia Record.*]

One of the most remarkable electrical storms at sea, which probably seemed intensified by reason of the fact that a cargo of Spanish iron ore passed through it, was experienced by the British steamship Mercedes, which arrived at this port yesterday from Bilbao. On the Grand Banks of Newfoundland during the nights of December 3d and 4th the ocean appeared like a mighty mass of flames or an endless stretch of prairie fires. Balls of electric fire hissed and exploded in all directions and darted among the vessel's masts and rigging.

The Mercedes' escape from going down on December 1st seemed little short of a miracle. She was struck by a south-southwest gale, which was accompanied by seas rolling fearfully high. During the height of the storm a huge deck derrick, weighing many tons, was torn loose from its fastenings and swept overboard, leaving a hole in the vessel's deck through which the water ran into the cargo. In its course it carried away the main topmast, which was also of iron, part of the flying bridge, the after winch and part of the deck fittings. The decks were flooded with tons of water, the ship rolled at an angle of 70 degrees, and the sea broke in all directions, filling the cabin and the officers' quarters.

Soon afterward the storm partially subsided, when the electrical fire appeared in all directions. It hung in big balls for two nights from the masts and fore and aft stays, and practically turned night into day. As the big fire balls came together they would burst with a loud report upon the vessel and disappear. Under this light at night such temporary repairs were made as were deemed necessary to reach port.

Capt. Tait of the Mercedes stated that the passage was one of the most trying experiences of his life. The rolling and lurching of the vessel in the storm and the fury of the gales were terrific in the vicinity of 25° longitude. Only the heroic work of the officers and crew saved the vessel, as all the shipping men about the Maritime Exchange yesterday agreed.

## Magnetic Action on a Current in an Aluminum Wire.

Among the singular properties of aluminum which distinguish it from other metals, is its extremely feeble volatility at high temperatures. While this metal melts at an intermediate temperature between that of zinc and of silver (1,250° C.), it can be carried to a white heat without sensible sublimation and without coating with deep oxide. At this temperature nearly all metals with a lower fusible point are either partially volatilized or materially [illegible].

If a current sufficiently intense to heat it to the point of fusion is sent through a fine aluminum wire, it may be

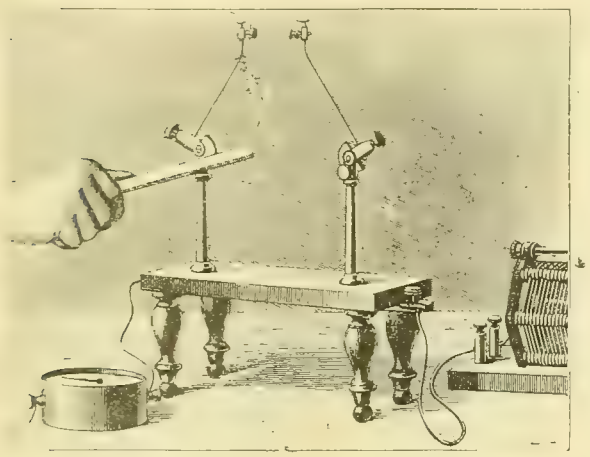


FIG. 1. MAGNETIC ACTION ON A CURRENT IN AN ALUMINUM WIRE.—EXPERIMENT WITH INCANDESCENT WIRE.

driven to a blinding white heat and yet maintain its integrity, unlike other metals similarly affected. These last when tested in a like manner, on reaching their fusing point, suddenly light up and give way, each extremity of the rupture forming into a small metallic globule produced by the contraction due to the superficial tension of the liquefied metal.

Aluminum behaves quite differently. If the wire is held firmly between two supports which are conductors of the current, it will curve inwardly, but will maintain its form in a state of incandescence up to the moment of rupture, which usually occurs near the point of attachment.

The wire in this experiment, Fig. 1, is evidently in a fluid state, oscillating with the least breath, and held in the air by the cohesion of its molecules, probably because of the formation of a very attenuated coating of metal which serves as a sheath or tube around the molten metal. This film must be of extreme thinness, for a microscopic examination failed to discover the least traces of oxidation. It has more the appearance of a rough casting. The surface is in a condition of brilliant ebullition, covered with cracks,

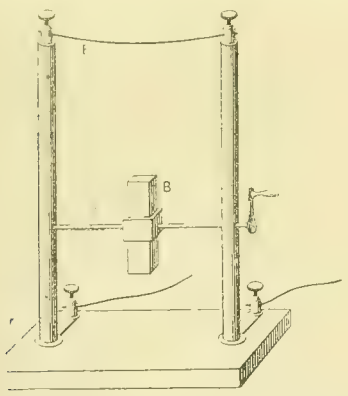


FIG. 2. MAGNETIC ACTION ON A CURRENT IN AN ALUMINUM WIRE.—EXPERIMENT SHOWING ACTION OF MAGNETISM ON A CURRENT.

with here and there a discolored, dark spot, having the appearance of graphite; in other words, the wire is evidently in a species of crystallization. In vacua produced by an ordinary air pump it still maintains its cohesion, as before, but preserves a more perfect homogeneity than in the air.

A wire 25 to 30 centimeters long and three-tenths millimeter thick, fixed by the extremities so as to allow it to form a loop, as shown in Fig. 1, will show another peculiarity when heated to an incandescent temperature. If now we present a bar magnet to the loop, the filament will be either attracted or repelled, depending upon the direction of the current or the pole of the magnet. This action may be sufficiently powerful to cross the loop and thus short-circuit and fuse the filament by reducing its resistance.

Prof. Margot, from whose communication in *La Nature* these facts are condensed, might have mentioned that the ordinary carbon filament in an incandescent globe is also susceptible to the action of magnetism in a similar manner.

M. Guillaume, who contributes some additional information on the subject of heated aluminum, says that the sheath or tube which serves to hold the fused metal in position, is undoubtedly a film of rust, and that this same film is the bar to the ready soldering of aluminum, which in all cases must be perfectly freed from all traces of, and protected from contact with, the oxygen of the air by cleaning and coating its surface at the time of soldering.

This extremely light metal, says the last named contributor, and its persistency of form when thus fused, permit of a pretty experiment, as shown in Fig. 2, where, by rotating the magnet placed above or below a filament so situated, the motion of a pendulum may be imparted to it, or by another application of a magnet one may compel it to assume various curves.

## Pacific Cable Company.

The Pacific Cable company was incorporated at Trenton, N. J., December 16th, with a total capital stock of $1,000,000, divided into 10,000 shares, the names of the incorporators and the amount of stock held by each being: Abram S. Hewitt of New York, 1,500 shares; D. O. Mills of New York, 1,000 shares; G. M. Dodge of New York, 1,000 shares; Fred D. Grant of New York, 500 shares; Wager Swayne of New York, 500 shares; James J. Hill of St. Paul, Minn., 1,000 shares; Z. S. Spaulding of San Francisco, 2,500 shares; John H. Browning of Tenafly, N. J., 1,000 shares, and Mason W. Tyler of Plainfield, N. J., 1,000 shares.

The object of the corporation is stated in the papers filed to be the construction and operation of electric submarine cables in the Pacific ocean with telegraph lines and connections for the transmission of messages. Connection, it is understood, will be made with the Hawaiian Islands. Offices are to be maintained in Jersey City and San Francisco, and business will be commenced on January 1st.

Ex-Mayor Hewitt of New York, who is one of the largest shareholders in the new cable company, is quoted as saying:

The government of Hawaii has granted to Col. Spaulding, a well-known planter of the Hawaiian Islands, a concession for a cable to the United States, with a subsidy of $40,000 a year. Col. Spaulding came to New York for the purpose of forming a company to lay the cable, but a subsidy of $40,000 a year is certainly inadequate to pay the interest on the outlay and expense for maintenance, which it is estimated will be about $300,000 a year. In the last Congress a bill was introduced and passed by the Senate authorizing the president to contract for a cable to the Hawaiian Islands at a cost not to exceed $3,000,000. The bill failed in the House, where it was thought that a corporation would be a better agency for securing a cable, because, for commercial and general purposes, government ownership and general management are not desirable.

Col. Spaulding's idea is to apply to the government of the United States for a sufficient subsidy to warrant the laying of the cable and for its maintenance. As the enterprise is of great public and commercial importance, several prominent gentlemen have agreed to co-operate with Col. Spaulding and to furnish the money required, provided the subsidy is secured. Their object, however, is not to make any money out of the enterprise, and hence, in the bill which will be presented to Congress, provision is made that the United States government may at any time release itself from the subsidy by taking the cable from the company at the actual cost of construction.

In other words, the object of these gentlemen is to secure to the United States the advantages of cable communication with the Hawaiian Islands, in the hope that the cable at some future time may be extended to Australia and China, with which countries we have large and growing commercial relations.

## Philadelphia Street Railway Strike.

A dispatch from Philadelphia on the 20th stated that the great street railway strike was over, as the Union Traction company, owner of the street car lines involved, had consented to arbitrate the differences with its employes. The cars were then running as usual. There were a few cases of violence and a number of cars were run out under police protection.

A later dispatch, however, gives the information that the company repudiated the arrangement for settlement, and that the situation is unchanged. Public sentiment seems to be with the strikers.

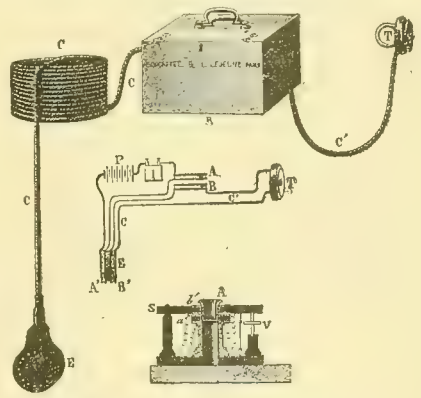
## Electric Submarine Explorer.

This apparatus is based on the principle of Hughes' induction balance, and is intended, according to *L'Eclairage Electrique*, for the discovery and location of metallic masses, sunken vessels, anchors lost in the ocean, and metallic veins. Like Hughes' induction balance, it is composed essentially of two pairs of bobbins, *A B* and *A' B'* Fig 2. The bobbins *A A'* are the inducing coils, the direction of the windings being such that a current through these flows in contrary directions. In the primary circuit a battery *P* and a clockwork interrupter *I* are placed, with a toothed wheel and platinum spring contact, which interrupts the current. Lying parallel and in close proximity to the coils *A A'* are the secondary or induced coils *B B'* in the circuit with the telephone *T*. The interruptions or variations of resistance produced in the circuit of the primary develop induced currents in the secondary, and the effect is distinctly noted in the telephone *T*. But if the winding of *B B'* or the contacts are such that the action of *B* on *B'* balances that of *A* upon *A'*, or, in other words, when the induced currents destroy each other completely the telephone remains mute.

Now by constructing the four bobbins as exactly similar as possible, and regulating the distance between *A* and *B*, through the adjuster, Fig. 3, this condition of silence in the telephone is obtained.

The apparatus being thus regulated, if we approach one of these groups with a metallic mass, the equilibrium is at once disturbed, and the telephone gives notice of it, the sounds varying in intensity according to the size, distance and orientation relative to the bobbins.

The explorer here described comprises all these parts. In Fig. 1 the box *B* contains the adjuster, the battery and



FIGS. 1, 2 AND 3. ELECTRIC SUBMARINE EXPLORER.

the vibrator, the whole being portable. The fixed bobbins *A' B'* are closed in insulating compound, waterproofed, and attached to the extremity of a long cable *C*, as shown, and may be used to explore the crevices of mines, the bottom of a river or the bed of the sea, with equal success.

## Chicago North Side Electric Elevated Road.

Work has been begun at Fullerton avenue on the erection of the structure of the Northwestern "L." Officials of the company say that work will be pushed with such rapidity that trains will be running by January, 1897. It is announced that the trains, when put in operation, will run south on Fifth avenue to Van Buren street, and on Wabash avenue from Harrison street north to Lake street.

Work on the road has been rushed for several weeks past. All but about the space of two miles is provided with foundations for the superstructure. The contractors who are putting in the foundations are engaged in doing the same work for the Fifth avenue and Wabash avenue sides of the union loop. More or less delay has occurred in the work down-town, owing to the obstacles presented by the mass of conduits in the streets named, but it is understood that the contractors will soon be able to transfer a portion of their men to the North Side work.

Much of the iron material for the Northwestern "L" is already on the ground. The structure will be pushed north at first, and as soon as practicable another gang will be put on to work southward from Fullerton avenue.

The running of trains to Van Buren street and Harrison street implies the use either of Clark street or Pacific avenue from Van Buren to Harrison street. The property owners on Van Buren street have nearly all, it is claimed, signed the agreement drawn up by the executive committee of the association to resist the loop.

The Owatonna, Minn., electric light plant was recently compelled to shut down owing to its well giving out.

## Transmission of Energy by Polyphase Currents in the Soignies Quarries.

Some of the most interesting electrical transmission plants of Continental Europe are to be found in stone quarries, where the advantages of electrically transmitted power are particularly obvious. One of these was described in a recent paper read before the Association des Ingenieurs Electriciens of Liege, Belgium, from which the following abstract is translated:

The territory under consideration has an extent of 52 hectares, and was formerly all operated by a central steam

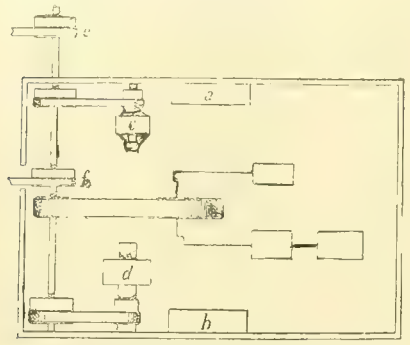



FIG. 1. TRANSMISSION OF ENERGY BY POLYPHASE CURRENTS IN THE SOIGNIES QUARRIES.—PLAN OF ENGINE AND DYNAMO ROOM.

plant, with a consumption of four to five kilogrammes per horse power hour. The present plant, which is electrical, performs the same labor with a consumption of less than one kilogramme. This saving is worthy of investigation.

The boilers are three in number, Cornwall-Galloway type, with two fire chambers, each with a surface of 80 square meters, the doors being automatically held closed except when proper attention to the draft has been first given, which prevents careless firing.

The water of condensation is not alone utilized for feeding the boilers. The source of this supply is 200 meters distant. The water is forced over by a pump into a tank on the roof of the main building. Part of this water under pressure furnishes smaller boilers of crane machinery, locomotives, etc., distributed through the quarries.

The steam engine is compound and parallel with a variable cut-off, and has a capacity of 350 horse power. The flywheel weighs 12 tons and has a diameter of five meters; it is placed between the two cranks and transmits its power by a cotton belt. As shown in Fig. 1, the pulleys at the extremes of the shaft within the dynamo room carry severally, the one the triphase alternator *d*, the other the illuminating dynamo *c*. The two pulleys *f* and *e* drive the saws.

The continuous current dynamo is of the tetrapolar type, shunt wound, with drum armature, and having two brushes. This generator developes 300 amperes at 125 volts—or 37.5 kilowatts. Only one-half this power is used for lighting. The machine is remarkably compact for its capacity, but the neutral line is extremely sensitive to variations of load, and there is constant necessity for watching the brushes.

The triphase generator is of the Oerlikon type, with fixed armature and inner revolving field. The cast-steel inductor is composed of two equal parts—a crown of north

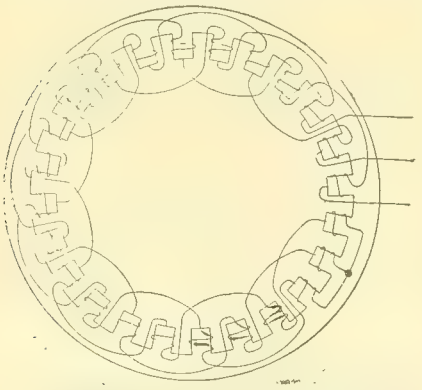


FIG. 2. TRANSMISSION OF ENERGY BY POLYPHASE CURRENTS IN THE SOIGNIES QUARRIES.—WINDING OF TRIPHASE GENERATOR.

and one of south poles; the exciting spool, well ventilated, is completely protected from exterior damage. The exciting current is led to two rings, and is produced by a small dynamo of the horseshoe type, of which the armature is fixed on the shaft of the alternator and the fields on a bracket cast on the frame. The alternator, with full load, requires an induction current of about 10 amperes at 35 volts. The surfaces and the pole-pieces are of laminated soft iron, the pieces being first riveted together and then forced into the curved forms.

As to the winding of the armature, there is no essential difference between the triphase and the ordinary alternator. The number of poles of the field is 16—eight north and eight south—while the armature has 24 poles. Consequently the arc corresponding to one complete period is thus divided into three parts, resulting in three phases. The difference, then, is two-thirds between any two currents, and the spools may all be wound in the same direction. Fig. 2 shows the connections, except that the wires figured as being within the circle are in reality at the opposite extremities of the coils. The coils are wound separately, slipped on the cores and fastened, wedges and leather sheaths holding them in place.

For high tension (5,000 volts at the poles of the dynamo, without transformers), the spools are wound with wire, but for the medium tensions bands of copper are used, while for the lowest—below 100 volts—the construction is slightly modified; bars are used in place of bands.

The coils are connected in the star form. The pairs of poles being eight and the speed 360 revolutions the frequency is of course 45.

The maximum load of the machine corresponds to 250 amperes in each branch; the theoretic energy then is $3\times250\times220=165{,}000$ watts, or about 246 horse power at the shaft, but the efficiency realized is less and divided as follows:

| | |
|---|---|
| Illumination | 57 horse power |
| Sand saws | 50 " " |
| Diamond saws | 45 " " |
| | 152 |

The distribution board is a model of simplicity. There are four ammeters with a range of 120 singly, one for each branch line from the bus-bars, four tripolar switches, one general ammeter, one voltmeter having one of the terminals connected to the neutral point of the star, the other to one of the poles of the dynamo by means of a switch.

The cut-out fusibles are behind the board. Twelve

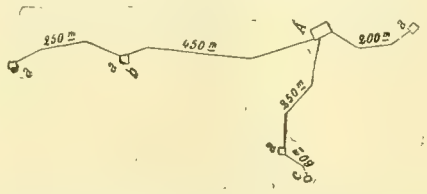



FIG. 3. TRANSMISSION OF ENERGY BY POLYPHASE CURRENTS IN THE SOIGNIES QUARRIES.—MAP OF POWER CIRCUITS AND MOTORS.

lightning arresters are connected to one plate where the aerial lines enter the power house. There are also measuring instruments on the exciter lines. The tension of the machine is hand regulated on the exciter circuit by the aid of a rheostat.

The installation comprises six motors, as follows:

(*a*) Four motors of 24 horse power, or 96 horse power.
(*b*) One motor of 18 horse power, or 18 horse power.
(*c*) One motor of 9 horse power, or 9 horse power.

Total.....123 horse power.

The drop from the generator being about 7 per cent. there is left a reserve of about 25 kilowatts.

Fig. 3 shows the comparative distances from the power house *A* to the various motor installations, *a*, *b*, *c*. The maximum distance is seen to be 700 meters. The motors are all hexapolar.

Finally, from a technical and economical point of view, from the cost of installation to the final results, as between the continuous and alternate currents, there is little to choose. The only advantage lies with that system which can furnish the lightest and simplest motors.

The Soignies quarries is the first industrial institution in Belgium where the alternating current has been used, and the projectors are entitled to much credit for their daring in thus hazarding the experiment.

## Postal Telephony.

*To the Editor of the* WESTERN ELECTRICIAN:

A communication from G. C. Maynard, as Washington correspondent of the *Electrical Review*, endeavors to discredit the writer in connection with a statement that the postmaster-general had considered some the question of postal telephony. As this G. C. Maynard is well known in Washington to be a Bell telephone man, it is to be expected that he would assume such statements. However, he has a few things to learn yet in the telephone line, although he probably thinks he knows it all, like most of his "kit." It is sufficient to state that the inferences of his communication are false, and that the postmaster-general was either guying him or did not think his interest in an effort to obtain information warranted the giving. The postmaster-general and the writer did discuss matters of postal telephony.

J. E. KEELYN.

## Cost of Operation on the Metropolitan Elevated Road.

The Metropolitan West Side Elevated Railroad company of Chicago, using electrical power exclusively, has shown that an elevated electric railway can be successfully operated during the storms of a northern winter. It is known, too, that a great saving is obtained by generating the power in one station and by discarding steam locomotives and high-priced enginemen and firemen. The exact figures of the cost of operation have hitherto been withheld from the public, although eagerly awaited. The *Chicago Tribune*, however, claims to be in possession of some general figures on the subject. The article is rather indefinite, but it is of considerable interest, nevertheless, and is herewith given:

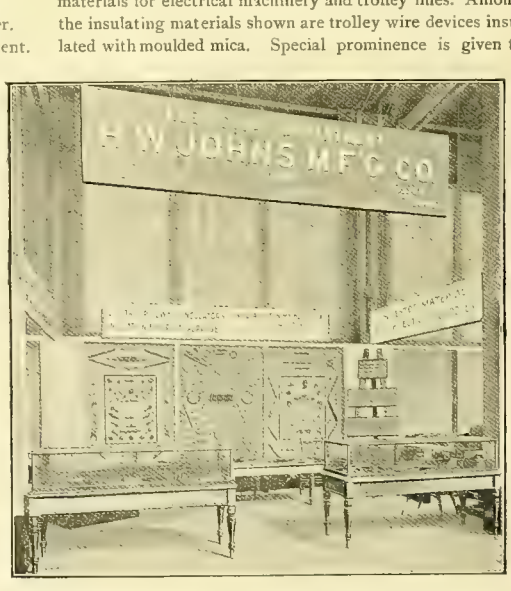
The Metropolitan Elevated railroad is operating trains on its line at 22 cents a train mile. The cost for operating the Alley "L" is 47 cents a train mile, and for operating the Manhattan Elevated in New York it is 45 cents a train mile. This shows a cost of less than one-half the cost of operating with locomotives, and it is said the expense will be further reduced when the southwestern branch is in operation and when the tunnel connection with the Chicago river is completed and the company is able to secure water needed without cost. The Metropolitan officials will not give out the absolute passenger traffic of the road. They say, however, it is averaging more than 55,000 a day, and that the traffic for November and the first half of December was sufficient to meet all fixed charges and to pay interest upon the present outstanding issue of bonds, amounting to $10,000,000. The company is progressing with its southwestern branch, and already it has nearly all the foundations in for the portion of this branch running from the main line south to Twenty-second street. The last of the condemnation suits has been completed, and the company can begin work upon the superstructure as soon as it may desire.

On the branch running west along Twenty-second street nearly all the right of way has been secured, and it is expected the company will have this branch in operation in the early spring. The cost of generating electrical power will not be materially increased when the Douglas Park branch is in operation. It is expected the cost of operation will be reduced to 20 cents a train mile when all the system is in operation and when certain improvements are made which are now in contemplation.

This showing of the Metropolitan gives an idea of the saving in cost to be effected by the Lake Street when the road begins the operation of its trains by electricity. While the exact proportion of operating expenses to gross income of the Metropolitan is not known, it is said to be between 45 and 50 per cent. The operating expenses of the Lake Street during last year amounted to a little more than 67 per cent., and while predictions were made that this would be considerably reduced during the present year it was not expected it could be cut lower than 60 per cent., if that low. The operating expenses of the Alley "L" have been exceedingly heavy, running from 75 to 80 per cent. of the passenger receipts. With a good electrical equipment this could be cut to 50 per cent., and perhaps even lower.

## H. W. Johns Manufacturing Company at Atlanta.

One of the exhibits in the electricity building at the Atlanta exhibition which has attracted attention has been the electrical exhibit of the H. W. Johns Manufacturing company, which shows an attractive arrangement of insulating materials for electrical machinery and trolley lines. Among the insulating materials shown are trolley wire devices insulated with moulded mica. Special prominence is given to




H. W. JOHNS MANUFACTURING COMPANY AT ATLANTA.

the giant strain insulators with their combinations for clevis and large eye. Also the "J. P." hanger, which was introduced during the last year. Special attention is also ealled to the "H. W. J." mechanical clip, which has proven most satisfactory in service.

A large and comprehensive display is made of vulcabeston parts used in the controllers of various manufacturers,

the list practically including the makers of all controllers, such as the Westinghouse, General Electric, Steele, Sperry, Worthington, Walker and the Curtis Electric companies. There are a number of specimens of brass switches and crossings and the Philadelphia insulated crossings and trolley wire breaks. These are insulated with specially impregnated fiber, which renders the fiber non-absorbent.

The company exhibits a novel form of car heater, which consists of a resistance wire, interwoven with and insulated by asbestos. Tests have shown these heaters to be most economical, and also permit the use of a high temperature without detriment. Included in the exhibit is a device which introduces a new name to the trade—electrotherms. These are practically resistance mats, or pads, and are composed, like the car heaters, of a resistance wire insulated with asbestos. They are flexible and are covered with flannel or rubber, depending upon whether they are to be used for local applications of heat or in damp situations. They are specially adapted for medicinal purposes.

In glass cases are shown samples of moulded mica and Monarch insulating materials in a great variety of shapes for the insulation of switches, thermostatic and other devices, and vulcabeston parts as used in dynamos, motors, street car controllers and other electrical apparatus.

The company has received for its exhibits at the Atlanta exposition for asbestos manufactures and moulded mica and vulcabeston insulating materials one gold medal for superior excellence, two silver medals, two bronze medals and an honorable mention.

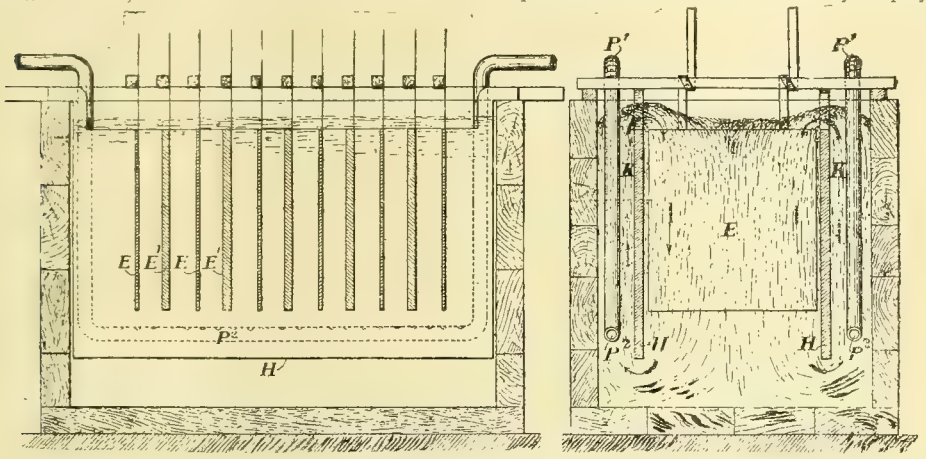



FIG. 2 AND 3. SIEMENS & HALSKE PROCESS FOR PRODUCING ELECTROLYTIC ZINC.—LONGITUDINAL AND TRANSVERSE SECTIONS OF THE CELLS.

## Street Railway Affairs in Milwaukee.

[From the Milwaukee correspondent of the WESTERN ELECTRICIAN.]

The McGann street railway ordinance is still hanging fire in the Common Council. It is expected that the matter will come up, but not for final settlement, at the next meeting of the Common Council. Two members of the committee on railroads, Aldermen Thuering and Devos, will report in favor of granting the franchise, with suitable restrictions, while the other three members of the committee will submit an adverse report. At the last meeting of the committee ex-Congressman P. J. Somers, who represents McGann and his Chicago associates, made a strong attack on the opponents of the new company. He told the aldermen that if they refused to give the people competition in street railway service, and thus prevented them from riding for 4 cents, the people would be sure to remember their course when they came up again for election to their seats in the Common Council. If they had the interest of the people at heart, he said, they would grant the franchise, and thus give relief to this monopoly-ridden city. He declared that there was no good reason why they should not grant the franchise. "However," he continued, "if you are bound to vote against the ordinance, come out squarely and admit that it is because the other company does not want you to give us a chance to compete." Mr. Somers then proceeded to relate how some of the members of the committee went to Chicago to try to ascertain the financial standing of the McGann company. He asserted that instead of going to the banks which had been cited as references, the Milwaukee aldermen had approached one of the conductors on the McGann line, and questioned him. "You might just as well have asked the man who washes the car windows," he said, and there was a laugh at the expense of the inquisitive aldermen. Mr. Somers spoke of the capital which was ready for investment in the enterprise, declaring that it was adequate, and he elaborated upon the financial and personal integrity of C. C. Bonney, the principal backer of the enterprise, who, he said, had looked into the matter and was confident that it would prove a profitable investment.

The aldermen are perplexed. There will be an election for aldermen next spring, and the friends of McGann have worked up considerable feeling in some parts of the city, hence the aldermen fear the consequences, so far as they themselves are concerned, in case they kill the measure. On the other hand, it is notorious that the Milwaukee Street Railway company has a firm grip upon many of the aldermen, who will do its behests at all hazards. To a man up a tree it looks as though the McGann ordinance, if it ever does get through the Common Council, will be so burdened with conditions and restrictions that it will virtually be worthless. This result may hoodwink the people, and it will certainly please the old company.

William H. Bennett has been appointed receiver of the West Side Street Railway company, whose lines now form part of the Milwaukee Street Railway company's system. The appointment was made upon the petition of John Archer and A. Stephan, two judgment creditors, whose claims have not been satisfied, and the new receiver will have power to intervene in the United States court, where the receivers for the general system were appointed, and look after the interests of the creditors of the old company. He has already made a demand for the books of the West Side Railway company. Judge Johnson of the state Circuit Court has not yet appointed a receiver for the general company. Herman Block, a judgment creditor, has asked him to do so, and the matter is under advisement. Block, like Archer and Stephan, got a judgment for personal injuries, and the claim has not been satisfied.

## Siemens & Halske Process for Producing Electrolytic Zinc.

Heretofore the electrolysis of zinc salts has not been carried on commercially, principally because the metal was precipitated in the form of spongy zinc, difficult of utilization, if the solution included the least alkaline or metallic impurity. This forming of zinc sponge may be prevented by violently agitating the solution, principally by means of compressed air currents which at the same time oxydize the impurities of the bath.

To accomplish this result the source of power $M$ (Fig. 1) actuates, besides the dynamo $G$, which furnishes the current through $C$ $C$ to the series baths $Z$ $Z$, a ventilating fan $R$, which delivers the air by the tubes $P$ $P$ and their branches, $P^1$ $P^2$, $P^1$ $P^2$ (Figs. 2 and 3) at the bottom of the cell frames at $H$ $H$, which hold the carbon anodes $E^1$ and the zinc anodes $E$, thus maintaining a circulation in the direction of the arrows. A current of 50 amperes per square meter, with cathodes of one meter long and 0.7 meter wide, requires for the best results a current of air of about 1.3 cubic meters per hour per cathode. With a bath containing a solution of zinc sulphate of 10° Baume density, and adding five to 10 grammes of sulphuric acid per liter, a deposit of perfectly solid, non-spongy zinc is obtained.

The zinc is deposited upon the cathodes and the oxygen is disengaged at the anodes. The volume of the bath remains nearly stationary. The acid must be added gradually and when the proper acidity of the bath has been accomplished, the cathodes should be properly cleaned before proceeding with the work. The cuts are taken from *L'Eclairage Electrique*.

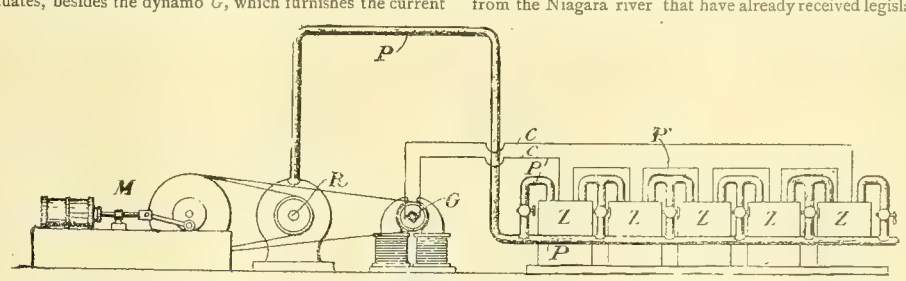



FIG. 1. SIEMENS & HALSKE PROCESS FOR PRODUCING ELECTROLYTIC ZINC.—ELECTRICAL AND PNEUMATIC CONNECTIONS.

## American Institute of Electrical Engineers.

At the monthly meeting of the council of the Institute, December 18th, the following named associate members were elected: Chas. F. Bancroft, Lowell, Mass.; Frank E. Herdman, Chicago; Richard Lamb, New York; Leon Le Pontois, Pittsburg, Pa.; Harry W. Ludlam, New York; Samuel G. McMeen, Chicago; Frank L. Scidmore, New York; Joseph P. Stone, Schenectady, N. Y.; Norman W. Storer, Pittsburg; Chester H. Thordarsson, Chicago; Harrison C. Wybro, Los Angeles, Cal.

The following named associate members were transferred to full membership: George Stephens, Peterboro, Ont.; George White-Fraser, Toronto, Ont.; Alex. Dow, Detroit, Mich.; Samuel G. Neiler, Chicago, Ill.; L. Knowles Perot, Phœnixville, Pa.; John Balch Blood, Schenectady, N. Y.; Franklin Sheble, Philadelphia, Pa.; William H. Freedman, New York; Andrew L. Riker, Brooklyn, N. Y.; John A. McCrossan, Rat Portage, Ont.

The following committee was appointed by President Duncan to consider the question of incorporation of the Institute and any revision of the constitution that might be necessary to comply therewith: W. B. Vansize, chairman; Prof. H. S. Carhart, W. F. C. Hasson, A. S. Hibbard, Dr. Cary T. Hutchinson, T. C. Martin, Townsend Wolcott.

## Brooklyn Street Lighting.

On Monday of last week the bids for lighting the streets and public buildings of Brooklyn by electricity during 1896 were opened. Singularly enough, the Municipal company, which covers the Eastern District, put in no bid. When called up on the telephone for an explanation, an official of the company said it had forgotten all about the matter, but would send in a bid later. The bidders were the Edison company, the Citizens' company and the Kings County Electric Light & Power company, the last named being the latest competitor in the field. It was the company's first bid. The bid of the Citizens' company was: For arc lights of 1,200 candle power, 35 cents a light a night. If 400 additional lights a night are needed, a reduction of 1 cent a light a night will be made. In the event of a reduction of the number of lights below those in use on December 31, 1895, the rate will be 40 cents. For lighting public buildings 2.2 cents per ampere per hour. The Edison company bid 35 cents for arc lights of 1,200 candle power and 17½ cents for 600 candle, all additional lights to be furnished for 20 cents a lamp a night. If the number is reduced, the rate will be 40 cents. The same company, for lighting public buildings, bid 0.8 cent per lamp hour for incandescent lamps of 16 candle power; 5 cents per lamp hour arc lights 1,200 power, 7 cents per lamp hour. The Kings County Electric Light & Power company offered arc lights of 1,200 candle power at 32 cents a lamp each night. This company's bid covers only Fulton street to Snediker avenue and Court street to First place. The company makes the same bid for streets on which it may hereafter have circuits as the department might designate.

## Diverting the Water of Niagara Falls.

The commissioners of the New York state reservation at Niagara Falls have steadily set their faces against schemes of those seeking to appropriate property of the state or get a foothold upon it for private, personal or money-making purposes. The great increase of projects to take water from the Niagara river that have already received legislative sanction, added to enterprises to utilize the more distant waters of the lakes, which waters are essential to the integrity of the Falls, has become the occasion of a general apprehension that the spectacle of the Falls is likely to be impaired. A recent report says that there are six power companies which now take water from the river above the Falls without compensation, and concludes: "In return for these immensely valuable franchises the state of New York has not received one cent of consideration. The state reservations at the Falls have cost the state of New York, in round numbers, $2,500,000. This reservation was founded and this immense sum has been expended to give the people of the whole world an opportunity to view at slight expense one of the grandest and most sublime scenes on the face of the globe, and if corporate and individual ambition is not checked and made subordinate to public rights, there is certainly danger that the Falls of Niagara, like the Falls of Minnehaha, will soon live in the tradition of song and story only, and will be sadly deficient in the amount of water flowing over their brink."

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JUST how the American electrical trade will be affected by the controversy between this country and Great Britain over the Venezuela dispute, is largely a matter of conjecture as yet, but it is to be hoped that any disturbance or interference in our trade relations with the South American state will be only temporary. There can be no doubt that the people of Venezuela prefer to trade with the United States, and it has been the policy of this government to cultivate that friendly feeling. As a result Venezuela has furnished an excellent market during the last year or two, and considerable electrical apparatus has been shipped there from this country. American construction companies have been favored there, too, and American workmen have done the greater part of the work of installation, thus far. There is promise of great development in that field, and it is to be hoped that this country will reap the advantage.

RECENT accidents on the Broadway cable line have again called attention to the subject of fenders. A former chairman of the Board of Railroad Commissioners of the state has written a letter to the present chairman of the board in which he asks "Why the present Board of Railroad Commissioners has not compelled the Broadway & Seventh Avenue Railroad company to equip its cars with 'a safety guard' in front of the wheels, in accordance with the seventh requirement of the board (as formerly constituted) imposed as a condition precedent to its approval of a change of motive power by the railroad company, as set forth in the official order of the board, dated July 31, 1890." It is not contended that there is a perfect safety fender, but the writer of the communication claims that the company has not taken advantage of the devices which are to be had to-day. Those which are now used, he says, are not of any practical value.

In Brooklyn and in other eastern cities the outcry against fenderless trolley-cars continues, despite the protestations of the companies that they are doing everything in reason to encourage those who are engaged upon the problem of perfecting a safety device that may be relied upon. It is to be regretted that there is occasion for these protests, but it seems impossible under existing conditions to avoid these accidents. No doubt carelessness on the part of the companies' employes and the public contributes largely to this state of affairs.

LATE advices from Milwaukee indicate that the Wisconsin Telephone company and its Milwaukee subscribers are in a fair way to arrive at a satisfactory settlement, the company making certain concessions which, in a measure at least, satisfy the demands of the subscribers. It is claimed, on behalf of the local company, that its net earnings have not exceeded 8 per cent. upon the investment and that it has not paid more than 6 per cent. per annum for several years. If this statement is made in good faith and if the company can satisfy the public of the justice of its plea, it will be a revelation to most people who are familiar with telephone properties in this country. The Wisconsin company has always been looked upon as a particularly favored corporation, occupying an advantageous field, and managed with care and good judgment, but if this statement gives a true indication of the condition of the company's affairs a revision of the opinion must be made. It is only reasonable to suppose that the gentlemen entrusted with the management of the company have administered its affairs carefully and intelligently, and on this ssumptioan it seems really remarkable that such a poor showing is made, provided there has been no juggling of accounts. Of course there are many systems of book-keeping, and the aim of some of them seems to be not to show the true condition of affairs, but when the statement is made that a company has not been able to show a net earning of more than 8 per cent. upon the actual investment devices of book-keeping are not to be considered. Are there any more Bell companies in the country similarly situated?

AS MIGHT have been expected, George J. Gould is opposed to municipal ownership of railways, telephones and telegraphs. The president of the Manhattan Elevated Railway company gave his views upon this subject before a legislative committee of inquiry recently. His views accord with those of other men who have had experience in the management of great public enterprises, as will be seen from the following extract from his testimony:

I do not believe in municipal ownership. I do not think it is a proper thing for the government to take up. It should be left to private capital. A government railroad is never run as carefully, financially or from a public standpoint, as one controlled by a private corporation. It doesn't pay in Europe, where it has been tried. The taxpayers pay. It is the same with the telegraph and the telephone. The postal telegraph in England has a deficit every year. Government ownership is a leaning toward socialism. Private capital should be left to develop these enterprises, and should take the risks. We tried government ownership, in a way, with the Pacific railroad, and it resulted disastrously for the government and the railroad too.

Whatever criticism may be made by those who differ with Mr. Gould, it will be generally admitted that his assertion that "a government railroad is never run as carefully, financially or from a public standpoint, as one controlled by a private corporation," is absolutely true. The same restriction applies to all enterprises conducted by municipalities. What better illustration could the people of Chicago desire than that furnished by the city lighting department? After much boasting and many absurd promises, the city electrician is compelled to admit that he has been unable to keep his promises, that he has failed utterly; and to-day the city has an elephant on its hands in Barrett's lighting scheme.

WHENEVER the daily papers chronicle the breakdown of the cable system, the suspension of traffic on the elevated roads or the blockade of the trolley lines, they invariably refer to the inconvenience to which the public is put by reason of these failures, which make it necessary to depend temporarily upon horse cars. It is certainly true that such accidents are aggravating, and it is also true that they annoy the railway companies just as much as they disappoint the public. Moreover, every such failure means a certain loss to the company, and anyone familiar with street railway matters will realize that these losses are by no means inconsiderable. If the public would bear these facts in mind, the street railway companies would not be charged with wanton disregard of the convenience of the public. But then it is possibly too much to expect a man to exercise common sense when he is delayed in getting home to dinner or a tempting to catch a train.

But there is one feature of these accidents which does not seem to impress the public, that is the fact that the improved service has created a demand for better transportation facilities than were formerly enjoyed. What are considered necessities to-day were only a few years ago beyond the command of the traveling public; the transportation companies could not at that time furnish such service, and the public was not educated up to an appreciation of it. Times have changed, and the people who a few years ago contentedly jogged along in horse cars, now grumble at a five minutes' delay on a cable, trolley or elevated line.

DESPITE the rabid opposition of a large portion of the daily press of Chicago and certain electro-political agitators, the business community is very generally in favor of the extension of the overhead trolley electric railway service in all but the busiest streets in the central business district. It is unquestionably true that a well managed trolley line, with regular, frequent car service, is of great advantage to the outlying avenues of trade, and the fact is very generally recognized. The recent action of the West Madison Street Business Men's association is a late confirmation of this truth. This street is the principal business artery of the great West Side. It has a cable railway at present, but the business men are not satisfied, and hope to see the existing service supplemented by a trolley line running directly to the heart of the city over the Madison street bridge. The present main effort of the association is to get West Madison street, from Jefferson to Center avenue, thoroughly cleaned. Substantial progress has been made in the matter of street improvement, but there are other matters which will be taken up in due time, and the trolley question is one of them. On Wednesday of last week a meeting of the association was held, and John M. Smyth, a prominent merchant, pointed out that the association had other objects than street cleaning. It was organized to promote and develop the best interests of West Madison street in every way. The interests of that street were the interests of the whole West Division. The best possible transportation facilities were needed, and he suggested a trolley line. Mr. Smyth moved the appointment of a committee of five to consider the trolley question with relation to the further development of West Madison street, with power to act for the association, and having behind it the pledged and united strength of the business men interested. His motion was adopted by acclamation.

In itself the trolley is all right. In the existing stage of development of surface transportation in American cities it is a necessity. Aside from the esthetic objection, the opposition to it can almost always be traced to ignorant prejudice or the clamor of commercial rivalry.

WILL the present Congress take up the subject of establishing a Pacific cable connecting this country with Hawaii? In the last Congress a bill was introduced and passed by the Senate, authorizing the President to contract for a cable to the Hawaiian Islands at a cost not to exceed $3,000,000. The bill was bitterly opposed by the administration and failed in the House. The plea was made by opponents of the measure that a corporation would be a better agency for securing a cable, because for commercial and general purposes government ownership and general management are not desirable. Now there is promise that the matter will again be brought up and in a form that will meet the objections raised to last year's measure. A private company has been formed in New Jersey by New York capitalists, headed by Abram S. Hewitt, to co-operate with Col. Z. S. Spaulding, who is the projector of the enterprise. Business men of New York who recognize the importance of the undertaking, are lending much encouragement to the project. Mr. Hewitt, who seems to be deeply interested in the movement, outlined the policy of the company in an interview which is reprinted on another page. He says that Col. Spaulding's idea is to apply to the government of the United States for a sufficient subsidy to warrant the laying of the cable and for its maintenance. Mr. Hewitt and his associates have agreed to co-operate with Col. Spaulding and to furnish the money required, provided the subsidy is secured. The scheme is not a money-making enterprise, and hence, in the bill which will be presented to Congress, provision is made that the United States Government may at any time release itself from the subsidy by taking the cable from the company at the actual cost of construction. The projectors of this enterprise say that they hope to secure to the United States the advantages of cable communication with the Hawaiian Islands, in the hope that the cable at some future time may be extended to Australia and China, with which countries we have large and growing commercial relations. The government of Hawaii, it will be remembered, has already granted a subsidy of $40,000 per year

## Underwriters' National Electric Association.

A meeting of the electrical committee of the Underwriters' National Electric association was held at the rooms of the National Board of Fire Underwriters in New York Tuesday, Wednesday and Thursday, December 10th, 11th and 12th. There were present at the meeting the following named members of the electrical committee: F. E. Cabot, superintendent of the construction and electrical department of the Boston Board of Fire Underwriters; C. M. Goddard, secretary of the New England Insurance Exchange; William McDevitt, inspector, Philadelphia Fire Underwriters' association; E. A. Fitzgerald, inspector, Underwriters' Association of New York State; W. H. Merrill, Jr., electrician, Chicago Fire Underwriters' association; A. E. Braddell, inment; A. M. Schoen, electrician, Southeastern Tariff association; W. A. Anderson, superintendent survey department, spector, Underwriters' association of the Middle Department, New York Board of Fire Underwriters.

Owing to the importance of the meeting, invitations had been extended to many members of the association not members of the committee. The following named gentlemen responded:

President Nichols of the National of Hartford; Vice-president Washburn of the Home of New York; Assistant Secretary Lowe of the L. & L. & G. of Atlanta; G. B. Lauder, inspector, New Hampshire Board of Underwriters; J. E. Cole, inspector, Boston Wire Department; G. W. Wilson, inspector, Boston Fire Underwriters' Union; E. V. French, inspector, Factory Mutual Fire Insurance companies; Ralph Sweetland and J. Couillard, inspectors, New England Insurance Exchange; J. C. Forsyth, inspector, New York Board of Fire Underwriters; Frank Kitton, inspector, Buffalo Association of Fire Underwriters; H. H. Hornsby, chief inspector, city of Chicago; G. F. Bottom, inspector, Kansas City Fire Underwriters' association, and M. L. Stern, city electrician, Denver, Colorado.

At this meeting the discussions and votes were not confined to the members of the electrical committee, but the full privileges of both discussion and voting were extended to all present.

Chairman Cabot opened the meeting with a short address, the recommendations in which were referred to a special committee, and on its report the following resolutions were adopted:

*Resolved*, That any increase of voltage on interior incandescent lighting circuits would result in a corresponding increase of danger to life and property, and that owing to the tendency toward the introduction of high voltages it be urged that extreme care be taken by inspectors and others in charge of such installations, without which we believe serious hazards may be incurred.

*Resolved*, That the members of this committee and other electrical inspectors here present pledge ourselves to exert our influence to further the enforcement of the rules and requirements of the National Board of Fire Underwriters, and to co-operate with the electrical bureau of said board in furnishing that bureau with facts which come under our observation regarding devices and materials which may not be constructed in accordance with these rules and the introduction of which would create a hazard to property.

*Resolved*, That we further agree that all bureau reports received setting forth such facts shall receive careful consideration and the findings of the report be followed out as far as possible in our respective territories, to the end that cooperative work along these lines may be established and uniformity of action in all essential matters secured.

*Resolved*, That the introduction of trolley wires in municipal districts is inimical to the safety of the property of the inhabitants of such districts, and that because of this fact all possible precautions should be taken by the managers of trolley roads throughout the country, to insure cutting the current off of the wires in case of fire in abutting property; also that trolley wires should be effectually protected against the possibility of contact between them and other conductors; also that trolley systems should be so arranged that practically no difference of potential, due to the effects of trolley roads, should exist between subterranean pipes.

A committee consisting of Messrs. French, Goddard and Sweetland was appointed to consider and report on the question of how best to guard against the hazard due to the possibility of the breaking down of the insulation between the primary and secondary transformer coils. This subject was considered important, especially in view of the tendency toward extremely high voltages in long-distance transmission.

The matter of preparing rules to govern marine wiring was referred to Mr. Sweetland for report.

The subject of protectors which should obviate the hazard due to the liability of wires, such as telegraph, telephone and similar signal wires, becoming crossed with electric light or power wires, was referred to a committee consisting of Messrs. Cabot, French and Merrill. This committee will report at a later date.

The secretary was instructed to submit his proof of the revised rules, as taken from the minutes, to the different members of the committee before sending to the printer. He was also instructed, in accordance with suggestions made by several members, that in compiling the rules the definitions be incorporated in the rules themselves instead of printed as an appendix. It was voted that the secretary advise all persons who sent in suggestions which were not adopted of the reasons given by the members of the committee for their rejection.

The changes made in the rules, while they were considerable in number, were very few of them radical, and the general class of work which now receives the approval of the underwriters under the present rules will not be greatly affected. It seemed to be the general opinion of those present that the rules were working satisfactorily both to the insurance and electrical interests, and that only such changes should be made as were necessary on account of the progress of the electrical industry itself, or where experience had shown that additions to the present rules were required. The following are some of the more important changes made, and are given in the order of the sections amended in the present rules:

The grounding of the frames of generators may be allowed when necessary by written permission, this change being made on account of the introduction of direct-connected and extremely large and heavy machines.

Switches for motors must hereafter plainly indicate whether the current is "on" or "off."

Rules were adopted requiring wires to be protected from mechanical injury in buildings when necessary; high potential wires by substantial boxing giving a reasonable air space, and low tension wires either by boxing or by an approved iron armored conduit tubing.

It was decided that the mesh of wire netting for arc light globes should not exceed 1¼ inches.

Switches on hanger boards must cut out both poles of the lamp.

The use of wire smaller than No. 14 B. & S. will not hereafter be allowed except for pendant and fixture work.

The rules as to the construction and painting or "filling" of moulding were made more explicit.

The rules for special wiring in breweries, etc., will require that joints and splices be avoided as far as possible, and that switches in damp places be mounted on porcelain knobs so as to give an air space behind them.

It will hereafter be allowable to draw strings into conduits for the purpose of pulling in the conductors, which should not be placed in the conduit until the mechanical work on the building has been completed as far as possible.

Hereafter cut-outs will not be allowed in the canopies or shells of fixtures.

Circuits must be arranged so that no group of lamps (whether on the same fixture or not) requiring a current of more than six amperes will be allowed to be ultimately dependent upon one cut-out, except that special permission may be given in writing for departure from this rule in case of large chandeliers.

Steps were taken which will tend to improve the character of double conductors, and hereafter, except for pendants and fixture work, a solid rubber insulation, protected by durable braid, will be required for flexible conductors.

Supports for motor ceiling fans must have an insulator interposed between them and the motor.

The electrical requirements of the standard for car barns and repair shops as contained in the schedule now used by a number of rating organizations are now to be incorporated in the rules.

Service switches must disconnect all of the wires entering the building; that is, on the three-wire system all three wires must be opened by operating the switch.

The use of brass sheathed interior conduit and vulca tubing will not hereafter be approved for bushings.

The use of incandescent lamps in series circuits for decorative purposes will be allowed by special written permission when installed in a proper manner.

Rules for electric heating apparatus were adopted which will require, in addition to the general wiring being done in accordance with rules, that the switches shall plainly indicate whether the current is on or off; that the attachment of the feed wires be in plain sight; that stationary heaters be treated as stoves, and that the flexible conductor necessary for use with flat-irons and other devices of a similar nature shall have an insulation that will not be injured by heat, such as asbestos, which insulation must be protected from mechanical injury by a substantial outer braiding.

The suggestion that the table of safe carrying capacity for wires was too near the actual limit of safety was referred to the chairman of the committee for tests, investigation and reports.

The matter of obtaining more effective and more efficiently constructed devices for automatic safety cut-outs, was referred to the committee on tests, with the request that it obtain all the information possible in relation to the proper construction of fuse blocks, length of fuses and efficiency of fuse metal, in connection with currents of varying quantity and potential.

The attention of the committee was called to the fact that it was claimed by storage battery experts that these batteries were extremely subject to damage by water in case of fire.

The committee on tests was requested to report a standard for iron or steel armored conduit which should meet the approval of the committee.

A communication from Edward H. Johnson of the Interior Conduit & Insulation company, setting forth the merits of that class of wiring, especially that of the iron armored conduit, and suggesting that insurance companies should encourage this class of construction by a reduction in the premium on risks so wired, was read and placed on file.

As the work of the electrical committee of this association has now become generally recognized throughout the United States by the boards of fire underwriters which have adopted the rules recommended by the committee, and as quite a number of cities have also incorporated these rules in their city ordinances regulating the introduction and maintenance of electric light and power wiring a brief sketch of the formation of the association and the work which has been accomplished by the association and its electrical committee has been prepared by the secretary, and is herewith appended:

In the summer of 1892 the secretary of the New England Insurance Exchange, after correspondence with the electrical inspectors of the underwriters' associations in the East, called a meeting of the electrical representatives of the eastern associations for August 18th at the rooms of the National Board in New York. This meeting was called without any especially prepared plan of action, and it was not felt advisable to ask for representatives from boards situated at a distance from New York city. The meeting, however, was more of a success than had even been hoped for. The rules as adopted by the National Electric Light association were taken as a basis, and were carefully considered and revised, section by section. Proofs of the revised rules were sent to all the underwriters' organizations in the United States, with notice that a second meeting would be held in New York city, and with the request that any suggestions in relation to the rules be sent to the chairman of the meeting. These organizations were also advised that a plan for a permanent organization of the electrical representatives of the underwriters would be presented at the meeting, and all were requested to send representatives to that meeting, which was held on December 6th of the same year.

At the December meeting a permanent organization was formed called the Underwriters' International Electric association, but at a later date the name was changed to the Underwriters' National Electric association.

The articles of association, which have only been slightly changed since their adoption at that meeting, provide "that any member, officer or employe of any fire underwriters' organization or fire insurance company in the United States or Canada may become a member of the association on application to the secretary." The officers of the association are a president, vice-president and secretary and treasurer. The articles of association also provide for an executive committee and an electrical committee, the latter to consist of nine members who shall be chosen from the electrical experts employed by the insurance interests. The officers are also ex-officio members of the electrical committee. All meetings of the association must be held at the National Board rooms in New York city. The officers and electrical committee, which have remained unchanged since the organization of the association, are as follows:

President—C. E. Bliven of Chicago.
Vice-president—W. A. Anderson of New York.
Secretary and treasurer—C. M. Goddard of Boston.
Electrical committee—F. E. Cabot of Boston, chairman; William McDevitt of Philadelphia; George P. Low of San Francisco; A. E. Van Geisen of New York; E. A. Fitzgerald of Syracuse; Edward Leloup of New Orleans; W. H. Merrill, Jr., of Chicago; A. M. Schoen of Atlanta, and A. E. Braddell of Philadelphia.

The rules formulated at the August meeting were again carefully gone over and amended as seemed necessary, after which every person present agreed to recommend to his association that they be adopted as the standard for the territory under its jurisdiction.

The next meeting of the electrical committee was held on August 17, 1893, in Chicago, and an adjourned meeting was held on September 5th, in Boston. As the rules adopted at the meeting in 1892 had then been in use by most of the principal underwriters' associations for nearly a year, the committee had the advantage of suggestions and criticisms drawn from the actual application of these rules, and they were again carefully taken up, section by section, and such changes and additions as experience seemed to indicate to be desirable were adopted.

At this meeting, also, the word "approved," which was frequently used in the first edition of the rules to describe wires and devices, was defined, and these definitions were incorporated in the rules themselves. A list of wires which had been found to comply with the requirements of the rules was also published and a resolution was adopted calling attention to the liability of the destruction of metallic substances, especially water and gas mains, buried in the ground, by electrolysis due to the ground return of single trolley street railway systems. This resolution was sent to the various boards of underwriters to call their attention to a matter which was of practically very recent development, and correspondence was invited on the subject.

The work of Mr. Merrill in Chicago in connection with the electrical committee is worthy of special notice. Starting first with the idea of collecting and distributing as full information as possible in regard to fires due to electricity,

he has gradually established a department which is of great assistance not only to the electrical inspectors of the country, but also to the insurance companies and their various field representatives. His fire reports on behalf of the committee have become well known and have no doubt had the tendency to lessen the number of electrical fires by calling the attention of the various inspectors to the probable causes which may develop an electrical hazard, as shown not simply in the experience of one man or in one particular section, but in the experience of many inspectors covering nearly the whole territory of the United States.

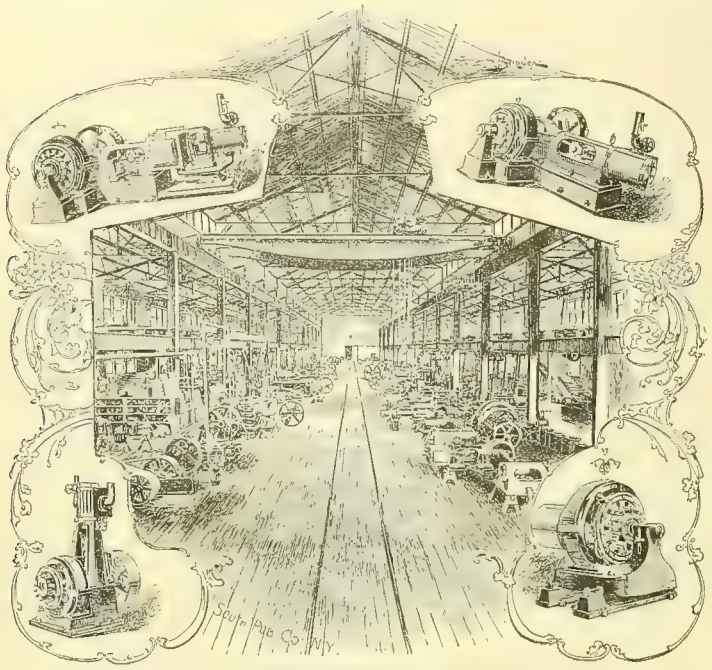


FIG 1. DETAILS OF M'EWEN ENGINE AND THOMPSON-RYAN DYNAMO.

Further than this, he has established a testing bureau and a system of distributing reports of the results of the tests there made, so that every inspector has the advantage of the experience and knowledge developed by a fully equipped and well managed testing laboratory. These reports have been of inestimable value in ridding the market of cheap and poorly constructed material and devices. The reputable manufacturers, being glad to remedy any defects shown in these reports, have improved their devices, and the goods of other less reputable parties have been to some extent driven from the market. It is the duty of every insurance inspector, and it is hoped that it will be the pleasure of all connected with the electrical interests, to furnish Mr. Merrill with as full data as possible relating to electrical fires and devices and materials which may come to their attention.

The next meeting of the electrical committee was held in New York on December 19, 1894. The changes in the rules made at this meeting were very few, but quite a large number of general subjects were taken up and considered and referred to special sub-committees. The most important action taken at this meeting, however, was the adoption, with the sanction of the committee on lighting of the National Board, of a resolution that the members present at the meeting would urge upon their respective associations an agreement to adopt and use the rules for safe wiring as adopted by the National Board of Fire Underwriters on the recommendation of the electrical committee, and that these rules should be printed only by the National Board, and that no changes or additions should be made except as promulgated through the National Board. The adoption of this resolution and the acceptance of the plan proposed by practically all of the underwriters' associations of the United States, at last brought about the result which was chiefly in the mind of the secretary of the New England Insurance Exchange when the first meeting was called, that is, an absolutely uniform set of rules for electric light and power wiring throughout the United States. That this result has been accomplished is shown by the fact that 40 underwriters' associations have ordered copies of these rules, all printed from the same type.

The electrical committee, feeling that the adoption of the rules recommended by it by the National Board and nearly all of the underwriters' organizations and their incorporation in the ordinances of some twelve or fifteen cities, had established the fact that their work had proved itself, so far as these rules were concerned, to be practical and satisfactory as a whole, considered that it was now in a position to invite general criticism from all those engaged in the electrical business. The rules had previously been submitted to and approved by representatives of the most prominent electrical manufacturers and central station men.

Early in October, 1895, the committee sent out a circular letter with blanks, practically broadcast, inviting such suggestions for changes or additions in the present rules as could be made and supported by what to the person making them seemed to be good and logical arguments for their adoption, with a statement that these suggestions would recieve careful consideration at the meeting in December. A very large number of suggestions were received, and these formed the subject of the discussion at the committee meeting in New York, which has already been reported. The successful conclusion of the committee meeting greatly encourages those interested in this subject, and it is predicted that the results of the organization's work will be of lasting benefit to all concerned.

## Details of McEwen Engine and Thompson-Ryan Dynamo.

During the year now closing the J. H. McEwen Manufacturing company of 26 Cortlandt street, New York, the well-known builder of automatic engines, has entered the electrical field and is now building dynamo-electric machinery in connection with its engine business. This departure was announced in the WESTERN ELECTRICIAN some time ago, and a description of the first electrical machinery installed by the company—the plant in the Rothschild department store, Chicago—was published in the issue of May 25, 1895. In the present article it is proposed to exhibit details of construction of both engine and dynamo.

The McEwen high-speed engines have been in the market about four years, and have gained an enviable reputation as high-grade engines. The company claims that for direct-connected apparatus much better results can be obtained when both engine and dynamo are built by the same company, assembled and thoroughly tested before leaving the works. Then again, all parts can be standardized and made duplicate, and can be turned out at less cost than it is possible when the engine is built by one company and the dynamo by another in widely different localities. The complete machine, having been thoroughly tested at the works, insures quick and satisfactory starting when it reaches its destination. This feature will be appreciated by those who have had experience in this line.

The company has a large and modern plant well equipped with special tools, electric traveling and hydraulic jib cranes, hydraulic lifts, etc.

Railroad sidings extend through the center of the main building, so that all heavy material, etc., is handled by power cranes. The facilities are such that first-class work can be turned out at a reasonable cost.

Fig. 1 shows an interior view of the machine shop, a steel structure built by the Shiffler Bridge company, Pittsburg, Pa. The central part, 60 feet wide, is spanned by a 20 ton electric traveling crane, having 30 feet clear head room and runs the entire length of the room, which is 260 feet. Within this area all the heavy machines are located. On either side is a wing 30 by 260 feet long, the second floors or galleries of which are equipped with light tools, vise benches, etc.

This company has made some recent improvements in the details of its engines, notably in the governor and cross-head. Fig. 2 is a cut of the governor, which is extremely simple, having but one bearing, and that a roller pin bearing, which requires no lubrication, so that the want of lubrication will not affect its regulation, and as the spring is the only part that is adjustable there cannot be any trouble from misadjustment. The engine must regulate nicely, as the builders state that they have given the following guarantee with every engine that they have sold, and have in no case failed to meet it:

The engine shall not run one revolution slower when fully loaded than when running empty, and a reduction of boiler pressure from the greatest to that necessary to do the work will not reduce the speed of the engine one revolution. Any engine failing to meet this guarantee becomes the property of the purchaser upon payment of one dollar.

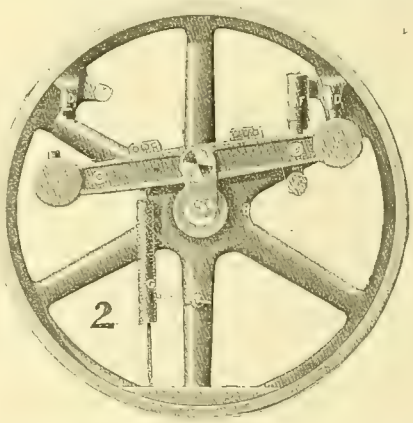
Figs. 3 and 4 show the construction of the cross-head. The shoes are held in position by eccentric bolts. To adjust position of shoes for wear, it is only necessary to loosen nut and turn the eccentric bolt to such an extent as is necessary to give proper adjustment. Then tighten nut, and it will remain in that position. It will be noticed that shoes swivel on the eccentric bolts, so that it is impossible for shoes to have anything but a full bearing. Both upper and lower guides, as well as cross-head pin, are oiled from stationary sight-feed oil cup on top of frame. The oil is wiped off by upper shoe, and is caught in oil groove shown, extending across the face of shoe, and led through oil holes at each end of grooves to inside of upper shoe; thence to a funnel-shaped oil hole in strap of cross-head box to cross-head pin; from there it drops to lower shoe and then through holes in this shoe to lower guide.

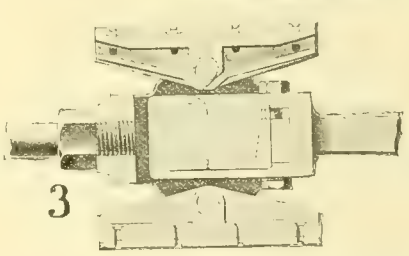
The shoes are faced with genuine babbitt, which is put on in such a manner that it is as solid as though it was part of the shoe itself.

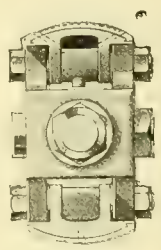
The Thompson-Ryan dynamo represents a radical departure from the beaten tracks of dynamo design, differing in nearly every detail of construction from the ordinary type of machine. The most important feature is a set of series windings surrounding the armature, and termed balancing coils. This feature, which is the invention of Prof. Harris J. Ryan of Cornell University, was introduced for the purpose of balancing armature reaction, and carefully conducted scientific tests show that it accomplishes the desired end perfectly. Having no armature reaction to contend with, the designers of the Thompson-Ryan dynamo have been able to introduce into their designs many important features never before possible.

At first thought it would seem that the addition of balancing coils to a dynamo would complicate the construction to a certain extent, and so it would if applied to the ordinary type. But all this is fully offset by the simplification of the machine in other respects. The field castings of these machines are of steel and consist of but three pieces, which are held together by four bolts. One of these castings is the "pole-ring," shown in Fig. 5, through which the balancing coils are wound; and the other two constitute the field ring proper, Fig. 7.

The balancing coils are wound in such a way that the current passes through them across the pole face in the opposite direction from the currents in the armature conductors, and thus the magnetic effects of the armature currents are neutralized.

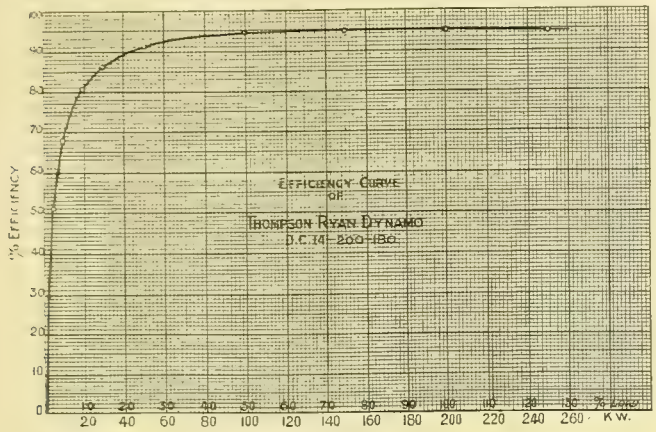


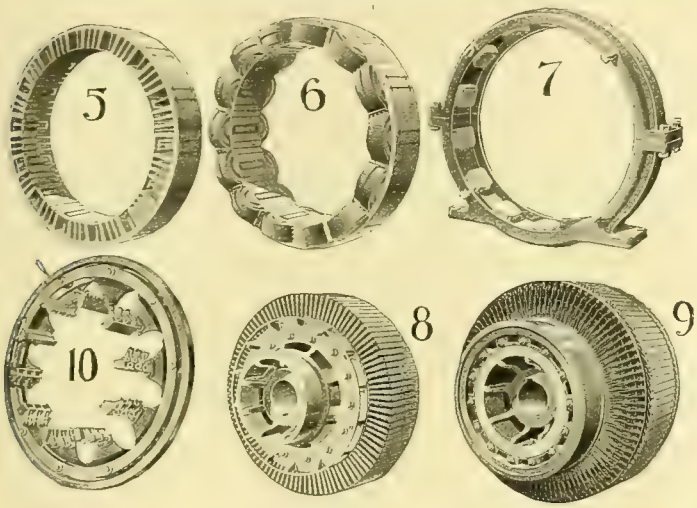




FIGS. 2, 3 AND 4. DETAILS OF M'EWEN ENGINE AND THOMPSON-RYAN DYNAMO.

Fig. 6 is a view of the completed pole ring. The field ring, Fig. 7, shows on its internal periphery the "pole necks," around which the coils are placed. It will be seen that the field ring is of such a shape as to entirely enclose the field coils, thus thoroughly protecting them from mechanical injury. It will be noted also that the space in the field ring allowed for the field coils is unusually small. This arises from the fact that less than one-fourth as much energy is required to magnetize the fields of this dynamo as is necessary for a machine of equal capacity of ordinary design. On account of the very small amount of field energy required the rise in temperature of the field coils is very slight, notwithstanding the fact that these coils are so nearly surrounded on all sides. No compound winding is used on these dynamos, since the balancing coils afford a compounding vastly more effective than the compound coils of the ordinary dynamo.




FIGS. 5 TO 11. DETAILS OF M'EWEN ENGINE AND THOMPSON-RYAN DYNAMO.

All of the armatures for the Thompson-Ryan dynamos, of whatever capacity and whether wire wound or bar wound, are constructed on the same general style. The cores are built of thin plates of a peculiar special steel, the distinctive feature of which is its unusually low hysteresis loss. The plates are stamped out in the form of rings, and a series of long slots are punched near the edges. These rings are then clamped firmly to a central hub or spider by means of brass end plates. There are no bolts passing through the laminated core, and no iron comes in contact with these plates. As a consequence of this there is no leakage of magnetism and no development of potential in any part of the core to cause eddy currents and waste energy. The holes in the plates form "tunnels" in which the armature windings are placed. Fig. 8 gives a very good idea of the appearance of the finished armature core.

It will be noted that the slots or tunnels are of unusual depth for this style of armature and, in the particular core illustrated, the depth of copper to be placed in each slot is at least three times as much as is used by most builders for an armature of similar size.

Another peculiarity of this machine is the large number of poles used. This feature, which in ordinary designs would be bad practice, is a valuable one of this peculiar style of design, enabling the builders to greatly shorten their armature conductors, and to use on all their armatures what may be described as the cylindro-hexagonal style of drum winding. In this winding all parts of every conductor of any particular layer on the armature lie in the same cylindrical surface, and the windings do not bend down over the end of the armature core at any point, and the conductors being placed through the core and below the surface, no binding wire is necessary.

The commutators of all of these machines are built of tempered copper, with pure mica insulation throughout.

They are carefully and solidly built, and, as a rule, are large in diameter and comparatively short in length. They are not mounted on the shaft, as is the usual practice, but are carried by a projecting ring of the spider. Fig. 9 is a view of the completed armature for a 200 kilowatt direct-connected railway generator.

One of the most important and noticeable features of these armatures is the ventilation. The armature being large in diameter, the central opening is also large and extends entirely through the armature from end to end, thus affording large heat radiating surface. The principal ventilation is effected by the winding itself. The conductors cross one another in such a way as to form a sort of open lattice work with innumerable radial openings through which the air circulates in great quantities.

But little heat is developed in the core of the armatures, since the quantity of iron is comparatively small and the magnetic density low, and the armature being short and the ends of the windings so thoroughly cooled, it will be readily seen that there is small danger of over-heating one of these armatures, even with excessive loads.

Fig. 10 is a view of complete brush-holder arrangement. The brush-holders project outward and leave the entire outer end of the commutator free and accessible.

The only leads employed on the whole machine are one from the negative brush holder ring to the negative terminal, and another from the positive brush-holder ring to the inner end of the balancing coils.

The brush holders themselves are very simple, and hold the brushes in such a way that they require no adjustment, but have only to be slipped into the holder. Working with brush holders absolutely fixed, there is entire freedom from sparking under any and all conditions of load.

The whole brush-holder arrangement is adjustable around the commutator, and by loosening the clamp bolts the brushes may be shifted backward or forward. This is only done, however, for the purpose of adjusting the compounding of the machine. By shifting the brushes in this way the machines may be adjusted through a range of from 10 per cent. drop at full load to 10 per cent. rise, and this without any effect whatever on the commutation.

Fig. 11 shows a curve of commercial efficiency taken from actual tests of a Thompson-Ryan 200 kilowatt railway generator. The peculiar features of this curve are not so much the good efficiency under heavy load as the unusually high efficiency under light loads and the very great range of uniform efficiency. This is due to the unusually small fixed losses, the result of the very small field energy consumed and the light core losses.

Another important feature of this dynamo is the great ease with which two or more machines may be worked in parallel. The design of the machine peculiarly fits it for this sort of service. They may be thrown in parallel while differing widely in voltage produced, and each machine will take its due proportion of the load, notwithstanding the fact that they may be greatly over compounded. Two or more of these machines will work perfectly in parallel, and divide the lightest load evenly or maintain perfect unison with the entire load thrown off.

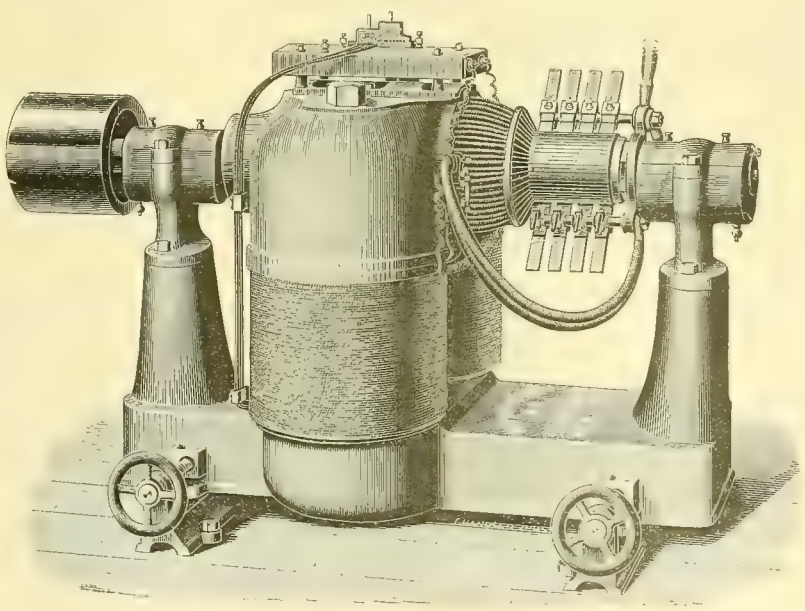
The Thompson-Ryan dynamos are built in sizes from 12½ kilowatts to 1,500 kilowatts capacity, both belted and direct-connected. Fig. 1 shows the belted dynamo as well as the dynamo direct-connected to the different types of the McEwen engines.

The manufacturers state they will be pleased to furnish handsomely illustrated catalogues of either their engine or dynamo to those who request them.

## Kester Dynamos and Motors.

The Kester dynamos and motors have become well known, and have very satisfactorily proved their efficiency in 37 states of the Union. The mechanical and electrical construction is excellent. Some of the special features of these machines are strong construction, low center of gravity and perfect balance of armature (insuring freedom from vibration, with minimum wear). The journals are supported by universal ball joints, thus obtaining perfect alignment. The cut represents the upright bipolar 110 volt 37 kilowatt dynamo designed for belt driving at moderate speed. The commutator has a much larger brush surface for the same current than is usually allowed. The armatures in the larger machines are wound in such a manner as to eliminate eddy currents, thus allowing the machines to stand considerable overload. The machines are so compounded, that after brushes are once set there will be no sparking, though the load be changed from nothing to full load.

The motors are similar in design to the incandescent dynamo, and in their construction have the same essential features, with the exception of carbon brushes. These motors are highly efficient and speed moderate, and the amount of power required to operate them is comparatively small in proportion to the work being done. They operate quietly and require but slight attention.

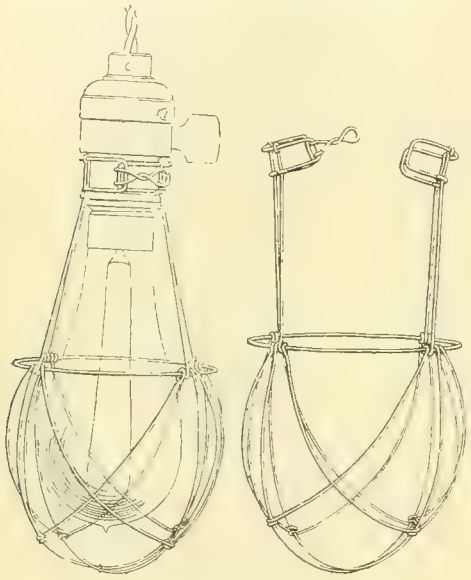


KESTER DYNAMOS AND MOTORS.

The manufacturer of this machine, the Kester Electric company of Terre Haute, Indiana, has within the last year made numerous special applications, in which the advantages of its machines have been clearly shown—such as rock crushers, rock drills, coal cutters, pumping and hoisting machines. The Chicago agency has recently been placed with Richards & Meacham, 84 and 86 La Salle street.

## Incandescent Lamp Guard.

To protect incandescent lamps from external harm a guard of some kind is often required. An excellent device of this nature is the "Perfection" lamp guard manufactured by William Inglis of Detroit, Mich., and shown in Figs. 1 and 2. One of the principal merits of the guard lies in the provision for fastening it. It is made to fit the socket very snugly, and the hasp or lock being put through the opposite loop and lapped over, as shown in Fig. 1, draws all the wires around the socket in the tightest possible manner and holds the guard upon the socket rigidly, thus protecting the lamp when put to the most severe usage. The fastening being made in the nature of a hinge, the guard can be easily taken off and replaced without bending the wires out of shape, which is so apt to occur with the guards made with slides. The "Perfection" guard, which is made to fit all styles of sockets, is of bright tinned wire, silver finish, and is exceedingly neat in appearance.



FIGS. 1 AND 2. INCANDESCENT LAMP GUARD.

## The Real and the Unreal Business Paper.

By N. C. Fowler, Jr.

Imitation is the order of the day. Imitators are everywhere. The real and the unreal live side by side. The good and the bad are neighbors. There are trade papers which are trade papers. There are trade papers which trade on the trade, and have nothing to trade with. The profitable trade paper is very profitable. First-class trade papers make money. All first-class men are successful. All honest men succeed. Dishonest men try to, and sometimes do.

There are papers masquerading under the names of legitimate publications which are nothing more nor less than advertisements bound together in pamphlet form. There are so-called trade papers which have no circulation, and which cannot get any circulation. There are trade papers run by men who know nothing about the trade they represent.

The popular impression that all trade papers are successful has thrown upon the market numerous illegitimate publications which attempt to float on the water which has passed, and to sail by the wind of others.

A trade paper can be three-quarters advertising, and yet be a good trade paper. A trade paper can be half clippings and yet be a real trade paper. The trade paper which is a trade paper is the paper which contains part advertising, part original matter, part clippings, and is of interest and benefit to its readers, and such a trade paper is obliged to have circulation. There is many a trade paper with half its circulation in the form of sample copies, but that does not seriously handicap its advertising value, for each sample copy is sent out as a means to obtain a new subscriber, and each sample copy reaches people of its trade, because it would not pay to send sample copies to folks of any other class.

The trade paper which is all sample copies is illegitimate—it has no right of existence. The trade paper which is all clippings is not a real publication. The trade paper which is all advertising cannot be classed in the first class. The trade paper which contains nothing but puffs is not worthy of consideration. The trade paper which has all of its reading columns for sale, and which sells nearly all of its reading matter space, is worthless as an advertising medium.

The trade paper has a perfect right to print a paid notice. Every publication, excepting a few of the magazines, do that. The trade paper can legitimately speak well of its advertisers—it ought to do that—the advertisers expect it. The trade paper which speaks illy of those who do not advertise in its columns is a trade paper which has no standing, and which is worth little. There are trade papers in the country which are nothing more nor less than blackmailing sheets, which the government ought not to transmit through the mails, and which are a detriment to the trade they represent, and to the honesty of the craft.

The legitimate trade paper, the trade paper of character, and the trade paper which pays the advertiser, is the trade paper which carries a large amount of advertising, for such advertising is as valuable to the reader as the reading columns themselves, for these pages of advertisements present pictures of progress, and tell the buyers what to buy as well as where to buy.

The legitimate trade paper contains a reasonable amount of reading matter, part of it original, and part of it copied. The legitimate trade paper balances its advertising with its reading matter, and its reading matter with its advertising. It prints legitimate reading notices. It speaks well of its advertisers, but it is not a paper of puffs—it is a paper of news and comment, simply the right combination of all that which makes up a first-class publication.

Beware of the trade paper which has a different rate for every advertiser. Look out for the trade paper which has a "Seeing it's you" concession for everybody. Look out for the trade paper which does not stand on its own dignity and say to the advertiser, "My space is merchandise. If you want it, you must buy it as you buy your clothes or your shoes." Look out for the trade paper that puffs everybody indiscriminately.

The trade paper can be known by the quality of its representatives. First-class advertising men work for first-class papers. Second-class advertising men work for second-class papers. The representative of the legitimate trade paper is a gentleman—a man worthy of your confidence. When he calls he is entitled to your consideration, and should be given an audience.

It is your business to discourage the illegitimate trade paper.

It is your business to encourage, with your money and your interest, the trade paper of character, for such a paper is as much a part of your business, and is as necessary to your business, as your desks and your counters.

# CORRESPONDENCE.

## New York Notes.

New York, December 20.—It developed at Tuesday's meeting of the Rapid Transit Commission that a suit had been begun at the instance of the *Sun* Publishing company, Franklin Bartlett, as trustee of the will of Henry Mason, and Mason Carnes, against the several municipal officers of the city and the Rapid Transit commissioners to restrain the payment of public moneys in the construction of a rapid transit road. Chief Engineer Parsons was mentioned as defendent in the suit against the commissioners, and the Board of Estimate and Apportionment was named in the suit against the city Secretary Delafield presented an estimate of the moneys which would be required to defray the expenses of the board for the period ending April 1, 1896, amounting to $30,118.62.

President Rossiter of the Brooklyn Heights railroad system says that the theater cars promised some months ago will be ready for use on January 1, 1896. There will be three of them. Each will be 25 feet long, running on eight wheels, and each one will be fitted up luxuriously. The interiors will be finished as finely as the interiors of Pullman cars. There will be heavy and expensive curtains and draperies, and the chairs will be richly upholstered with leather. Each car will have a buffet, and there will be other accommodations for the passengers. These cars will be for charter by theater parties, who will pay a certain charge for the trip. The cars will run all over the lines of the system.

A malicious attempt to wreck a trolley car of the Brunswick Traction company is reported from New Brunswick, N. J. A wire of heavy steel had been stretched across the road between that city and Milltown at a height to just miss the motorman's head. A car with eight passengers was going over the road at a rapid rate shortly after 10 o'clock at night, when the car was suddenly stopped, and all the lights immediately went out. The wire had smashed the headlight, torn a portion of the woodwork and disconnected the car from the trolley wire. The steel wire became entangled in the car truck, delaying moving for some time. The car had hardly started when a little farther on a tie was seen stretched across the track. Edward Radel, secretary of the company, believes that the attempt was made by discharged motormen.

Another curious trolley-car accident occurred in Brooklyn recently. A big poplar tree which has stood for many years in front of the house of George A. Powers, at No. 389 Washington avenue, fell to the ground at a few minutes after 1 P. M. It stood within a few feet of Greene avenue and fell directly across the avenue, snapping the trolley wires and brushing with some of its outer branches the top and sides of a Greene and Gates avenue car which was on its downtown trip. Had the car been five feet farther ahead, or had the trunk fallen the same distance farther east, the car would doubtless have been badly crushed, and the lives of its occupants endangered. There were no pedestrians or wagons within range of the trunk or its branches, and no injuries were reported. A strange feature of the incident was the fact that there was no wind swaying the tree at the time. The blocking of the track by the limbs and the breaking of the trolley wires delayed travel on both the uptown and downtown tracks for over an hour. W. F. O.

## In Tennessee.

Memphis, December 21.—The Gamewell fire alarm system is being put in at Jackson, Tenn.

An arc and incandescent lighting plant is being placed in the ferry steamer C. B. Bryan by Lee Whitfield of this city.

All of the electric roads of this city and suburbs have been consolidated under one charter, and the franchise granted to the company by the city council covers a period of 50 years. By this new arrangement transfers are given from 6 A. M. until 7:30 P. M., and several of the lines are to be extended. Frank G. Jones, vice-president and general manager of the company, is busy making preparations for the work.

The firm of Bruce & Boardman has been dissolved by mutual consent. B. M. Bruce takes the business and will continue it at 71 Union street. F. E. Boardman has accepted a position with the Light & Power company of Knoxville, Tenn., and will take charge of that plant as general manager.

The Memphis Light & Power company has fitted up a handsome suite of offices on the ground floor at No. 300 Second street, and has moved its office from the plant on Beal street. J. R.

## Northwestern Notations.

Minneapolis, December 21.—The Board of Public Works in St. Paul is securing information on electric lighting, both municipal and contract. The electric and gas light plants are all under one management in St. Paul, and if bids are asked it is feared that this would be the only concern bidding, which would take away the competitive part. But it is rumored that the Bohn Manufacturing company, which has a private plant for its own works, may put in a bid for a part of the city. Another rumor has it that the street railway company will enter a bid.

The Light & Traction Company of Dubuque, Ia., has been testing an electric heater in one of its street cars. While it does good work, Manager Balch thinks it too costly. It takes about eight horse power.

A committee is making an investigation on an electric light plant for De Witt, Ia.

Langsted & Croswell of Appleton, Wis., have the contract to install a 300 light electric plant for the saw mill of the Ross Lumber Company of Arbor Vitae, about 20 miles north of Rhinelander, Wis.

The city council of Mankato, Minn., voted to take bids for electric lighting and for electric street cars.

The electric light plant for Vinton, Ia., will soon be completed and in operation.

The new electric light plant of Worthington, Minn., is in operation.

The town of St. Ansgar, Ia., has a committee to investigate the matter of electric lights.

The Western Union is rebuilding its line between St. Paul and La Crosse.

W. L. Shanks and John Martin will soon put in an electric light at Big Timber, Minn.

C. E. Laws of Chicago will begin action against the Central Wisconsin Electric company of Oshkosh, Wis., to recover for two miles of track laid. An attempt has been made to continue tracklaying, but it was impossible and the city council threaten to forfeit the franchise if something is not done to show good faith.

The Janesville, Wis., street car system may stop, as it is not paying expenses.

The electric light company of Watertown, S. D., will stop operating unless receipts increase. The plant is not paying expenses at present.

The Cedar Valley Telephone company will soon have connection with Grundy Center, Toledo, and Tama City, Iowa. The company which is putting in a line at Marshalltown will connect with this system in the spring,

as will the company operating at Webster City. Connections are also to be made to connect at Waverly with a system which includes Charles City, Osage, Riceville and other points. The latter will be completed in the early spring.

About 50 new instruments have recently been put in at Fargo, N. D., making a total of 350 telephones in use there.

Delay in the arrival of the switchboard will prevent the opening of the branch telephone exchange in St. Paul until March 1st.

The Western Electric Telephone company of Britt, Iowa, has about 1,000 miles of wire strung and 101 stations, completing about all work projected for this season. In the spring it expects to put on a large force and extend its lines in every direction.

The new telephone exchange of the Iowa Union Telephone company at Decorah, Iowa, will be completed and in operation by January 1st.

Frank McCormick will build a telephone line along the line of the Missabe & Northern Railroad running north from Duluth.

A local telephone company has been formed at Centralia, Wis., and 53 shares were subscribed almost at once. They will not proceed unless they secure four-fifths of the users of the present system to subscribe for stock.

The Clark Automatic Switch company of Sioux City, Iowa, has been granted a franchise for a telephone system at Rock Rapids, Iowa, and has begun work on it.

Construction has begun on a telephone line to run from Sioux City, Iowa, to Yankton, S. D.

Peter Berard of Merrill, Wis., secured the contract to build a toll line between Wausau and Merrill, Wis., at $1,500. It will be the joint property of the Wausau and Merrill Telephone companies and is to be completed in 30 days.

A passenger on an Eighth avenue car in Minneapolis grasped at the wire furnishing current to light the trailer, when the car lurched and broke the wire. It fell and touched the metal on the dashboard of the car and gave out such a flash that the passengers on the platforms of both cars could not see for five minutes.

The Beatrice, Neb., council has under consideration an ordinance requiring all wires removed from the streets to the alleys. The council has also called an election for January 30th to vote on $10,000 bonds for an electric light plant.

The right of way is being secured for the electric line which is proposed to run from La Crosse to Neillsville, Wis., and the directors have decided to build it next summer. Fred H. Pickles of Winona, Minn., is the engineer in charge of the survey.

The Waterloo and Cedar Falls Rapid Transit company has incorporated with $600,000 capital stock, to build an electric car line.

L. E. Hall of Marshalltown, Ia., is an applicant for a franchise for an electric light and steam heating plant at Grinnell, Ia. Such a franchise can be granted only by a vote of the people, and petitions are being circulated to call an election.

The bondholders of the General Electric company of Winona, Minn., have arrived at a settlement and will reorganize. Motions will be made before the United States court in February.

It is understood that the street railway company may bid on the electric street lighting in St. Paul if the specifications call for a five-year contract, but if they call for a single year, the company will probably not enter a bid. It is also rumored that Taylor & Smith, who have a private electric plant, may enter a bid.

The Castner Coal & Coke company, of Belt, Mont., is having plans prepared for an electric light plant to light its mines and buildings and the village, to cost about $22,000.

The city of Brainerd, Minn, has voted to sell its electric light plant to C. N. Parker.

Winston Bros. of Minneapolis are the contractors for an ore railroad to be built between Ishpeming and Marquette, Mich. The force of gravity will carry the loaded cars down there being a fall of 800 feet in the 15 miles between Ishpeming and Marquette. Hiram A. Burt of Marquette, the president of the proposed line, proposes to utilize the power generated running down hill to carry the empty cars back again by having a motor car attached to every 10 or 15 cars, which will contain a dynamo. No brakes will be applied on the down trip, but the motor will be thrown into gear and the force otherwise wasted on brakes will be turned into electrical energy. This will be used to charge accumulators and taken off again by the empty train making the up trip.

Mr. Bartholomew of Grand Forks, N. D., is negotiating for the purchase or the electric light plant at Aberdeen, S. D.

The Seattle Gas & Electric Light Works, of Seattle, Wash., have been bought by a party of Minnesota capitalists, headed by Samuel Hill, president of the Eastern Minnesota railway. The plant will be enlarged and improved.

A franchise has been granted the People's Light, Heat & Power company at Hastings, Neb.

The Rocky Mountain Telegraph company will be succeeded by the Rocky Mountain Postal Telegraph company, which will extend a line from Butte to Denver via Salt Lake and Ogden. Connection with Denver will be made at Pocatello over the Union Pacific, probably via Cheyenne. The proposed line will be 1,500 miles long and the estimated cost is $350,000. Men are now in the East negotiating bonds, and it is expected that they will have matters completed by the middle of January. Work will be pushed rapidly after the bonds are sold.

St. Paul physicians are considering the advisability of organizing a school of medical electricity. M.

## PERSONAL.

A. L. Daniels, representing the H. B. Camp company of Aultman, Ohio, has been in Chicago for a few days.

Julius Auerbach, president of the Auerbach-Woolverton Electric company of Hoboken, N. J., was a visitor to Chicago last week.

C. J. Sturgeon, vice-president and manager of the Keystone Electric company of Erie, Pa., was in Chicago last week on a business trip.

## ELECTRIC LIGHTING.

The proposition to lease the Philadelphia Edison company to the Pennsylvania Heat, Light & Power company will be voted upon by the security holders of the first mentioned company on December 31st.

At a meeting of the aldermen of Waltham, Mass., the special committee on municipal lighting recommended that the city purchase the plant of the Waltham Gas & Electric Light company, and reported that the valuation of the plant was $253,000. The report was accepted.

The Gorham, N. H., Electric Light company has organized under a charter, and will henceforth be known as the Cascade Electric Light & Power company. The new company intends to fully develop its water power, estimated to be 2,000 horse power, and put in large light and power dynamos.

The project of getting power from Ridley creek to run a local electric light plant at the upper end of Chester, Pa., has been given up for the present. An engineer has tested the power of the stream, and finds that it is less than 100 horse power. One hundred and fifty horse power would be required by the plant.

The incoming Common Council of the city of Rochester, N. Y., will have the placing of the contracts for city lighting, which will amount to about $200,000 per year. Heretofore this service has been furnished by the Rochester Gas & Electric company, but it is reported that other companies will compete for part of the prize. The city of Rochester has gained the distinction of being one of the best lighted cities in the country, and the company now furnishing this service naturally bases its claim for preferment upon its former showing.

## ELECTRIC RAILWAYS.

According to Poor's "Directory of Railway Officials" there are 13,176 miles of surface street railways in the United States, of which 10,238 is operated by electricity, 578 miles by cable and 1,950 miles by horse power. The number of horses in use in these railways is now 45,353, which is about 145,000 below the number thus employed only four years ago. Of the 431 miles of street railway in Canada, only 40 miles is operated by horse power, electricity being employed on all the rest.

## TELEPHONE.

The Chicago Telephone company has made arrangements to establish an exchange in Rogers Park. The price of 'phones to patrons will be $42 for the exclusive use of telephones in Rogers Park, but a toll will be charged for the use of the telephones in down-town communications.

The United Telegraph, Telephone & Electric company has been organized to do an exchange business in Hyde Park, Chicago. Yearly contracts will be made at the rate of $36 for residences and $54 for business houses. The company announces that it will open its lines by January 15th with 500 subscribers. Twenty-five miles of poles and wires and 60,000 feet of underground wire are said to be in position now. The Stromburg-Carlson patents, known as the Stromburg telephone system, will be used. District messenger and telegraph service are also features of the new concern. The company bought from the County Court the franchise of the Hyde Park District Telegraph & Electric company, which was chartered by the old town of Hyde Park in January, 1889. The legal details were arranged so that the United company was empowered to proceed under the old charter. The officers are: President, John G. Earle; vice-president, James S. McConnell; secretary, E. P. McConnell; general manager, Thomas W. Sennott.

## TELEGRAPH.

The telegraph companies are prepared to handle the Republican national convention at St. Louis. Night Manager J. C. Barclay of the Western Union company at Chicago said: "There are hundreds of wires that can be used for the convention alone. We can easily send 65,000 words an hour from St. Louis to Chicago. We have wires from that point to New York direct, and by way of Chicago, Pittsburg, Indianapolis, or any of the cities that intervene. We can keep 50 men sending to Chicago direct, 20 men sending to New York direct, and have any number of side wires by way of other cities. We can as easily furnish New York 65,000 words an hour as we can Chicago. No; we are satisfied. Chicago is our best distributing point, but St. Louis is all right." Mr. Gregory of the Postal Telegraph company said that his company was in a position to handle everything that the newspapers or the public might want. He added: "We are well equipped in St. Louis, almost as well as in Chicago, and for business reasons we are glad the convention will be held there. We will have a longer haul to the east and will get some of the Chicago business. Of course we would have liked it here, but we will be able to take care of it all right in St. Louis."

## MISCELLANEOUS.

The report comes from Great Barrington, Mass., that William Stanley of Pittsfield is to establish a factory for the manufacture of electrical supplies in that town.

Ex-Congressman Jerry Simpson, replying to a letter of inquiry from a Greenfield, Ind., capitalist as to a proposed electric light plant at Medicine Lodge, Kas., wrote this characteristic letter: "Will say that Medicine Lodge is not the place you are looking for, for several reasons. First, not sufficient population and all too poor; can hardly afford to buy oil; too much protection and gold standard has done us up; corn 15 cents and everything else in proportion. Give us free silver and free trade and then you can come out west with your electric light plant. We need it, but at present we can stand it to read our mortgages by the lights of the 15-cent corn fire."

## TRADE NEWS.

The Sessions Foundry company has issued tasteful invitations requesting the recipents to attend the opening of the new works at Bristol, Conn., on December 27th, between 9 A. M. and 5 P. M.

Accurate measurement of time is a necessity. This gives us what we term "accurate time." The electric system furnished by the Standard Electric Time company of Waterbury, Conn., indicates this accurate time uniformly on many dials, making an equipment for schools, public buildings, factories, etc., that is valuable and that is coming into very general use. A time plant in a building is being considered as important as a lighting or heating plant. The company's automatic programme bell ringing attachment is connected with and run on the same accurate time as the self-winding regulator, which is used for the master clock. This may also be said of the electric tower clock, watchman's clock and electric time register the company installs. Its battery gauge is the only one of its kind.

In the Suffolk County Court yesterday, says the *Boston Transcript* of December 18th, the schedule of liabilities and assets of George D. Burton, the inventor and electrician, who is a petitioner in insolvency, were filed. Mr. Burton, who invented the stock car that bears his name, was the organizer and for a time the manager of the Burton Stock Car company, with plant in Kansas. Dr. J. C. Moore of Manchester, N. H., is largely interested in it. Others of Mr. Burton's companies were formed on patents taken out by him for electric forging, welding and heating. The Burton Electric Forging & Heating company, of which the debtor was president, operated in New England, and has its headquarters in this city. Mr. Burton has taken out a large number of patents, about 100, it is said. He was born and bred in New Hampshire, and came to Boston to find a field for his enterprise. He is about 40 years old. He owes $117,700, and has as assets stored machinery, stock in various companies, notes, etc., of what market value has not yet been determined.

## BUSINESS.

"Chain Blocks" are exhaustively treated in a pamphlet just issued by the Yale & Towne Manufacturing company. The report of official tests and a graphical comparison are given to show the great efficiency of the Yale & Towne blocks.

J. F. Shawhan, lately with the Shawhan-Thresher Electric company, Dayton, O., has disposed of his interest in this company and is now located at 30 South St. Clair street, Dayton, where he will be engaged in business for himself.

Continued satisfactory sales of the Garlock high pressure packing for steam plants are reported. This material is made of selected fiber and metal in combination with the Garlock packing compound, and is furnished in sizes ranging from one-fourth inch to two inches square.

The Electric Appliance company is rapidly securing its share of the interior conduit business. With a large stock and a high grade article at a low price, the company is making itself felt in the conduit field, which is becoming such an essential tributary to the electrical supply business.

F. M. Bernardin of Kansas City reports that he has recently placed large orders for electric light and railway poles in Missouri and Kansas, including 500 for the Metropolitan Street Railway company of Kansas City. Mr. Bernardin is also pushing the sale of the Warner electric car heater, which has met with considerable success, owing to its simplicity of construction and economy of current.

E. F. Peck, vice-president of the National Electric Light association, who for the last 10 years has been the general superintendent of the Citizens' Electric Illuminating company of Brooklyn, N. Y., has formed a company, to be known as the Peck Electrical company, with

an office at 15 Cortlandt street, New York. The company proposes to manufacture and deal in electrical specialties and supplies and also to engage in electrical engineering in all its branches. Mr. Peck's long and practical experience as superintendent of one of the largest and most successful electric lighting plants in the country, together with his recognized capacity as an electrical engineer, will undoubtedly command for the company a large share of public and private patronage.

The Michigan Electric company of Detroit, Mich., reports a most satisfactory growth of its business during the year. Since August, when the company was appointed Michigan agent for the General Electric company, it has been most successful in securing orders for machinery, etc., of the General company's manufacture, some notable contracts being: Newcomb, Endicott & Co., Detroit, one 35 kilowatt moderate speed multipolar generator; Hunter, Glenn & Hunter, Detroit, one 40 kilowatt multipolar directly driven, and one 17½ kilowatt multipolar moderate speed generator; Baldwin, McGraw & Co., Detroit, one 17.5 multipolar moderate speed generator; Mabley & Co. building, Detroit, four 130 and one 40 kilowatt, all multipolar directly driven lighting generators; Ann Arbor Thomson-Houston Electric company, Ann Arbor, Mich., one 120 kilowatt 1,040 volt alternating current generator, one 125 light 2,000 candle power Brush arc generator, one marble switchboard for alternating current and arc circuits. In sales of Edison incandescent lamps and General Electric company's lighting supplies it has secured a very large amount of business, the new type Edison lamp having proven a particular favorite with the trade. In the railway line the company has secured an order for four double General Electric 1,200 motor equipments for the equipment of the Oakland County railroad, to run from Detroit to Pontiac, and has the promise of a number of other orders for similar equipments. The General Incandescent Arc Light company's constant potential arc lamps have been pushed with such success that they are now used almost exclusively in Detroit and vicinity. The company has also had great success with the Simplex wire, having secured its exclusive adoption in the Chamber of Commerce, Home Savings Bank, Elliott, Valpey, and many other of the most prominent buildings in that section, including the new Mabley building (14 stories), which will be the largest building in Michigan. Other specialties for which the company is agent, such as Cutter flush switches, Automatic Switch company's motor starters, etc., have been pushed to such good effect that they are now universally used in all first-class installations. The Michigan overhead material, which this company manufactures, has had a very satisfactory sale.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

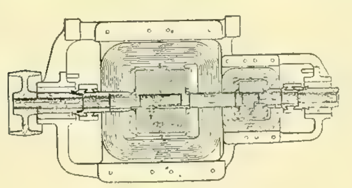
*Issued December 17, 1895.*

551,357. Incandescent Electric Lamp. Charles A. Beal, Abington, Mass. Application filed February 28, 1895.

One claim is for a double filament lamp, having a central contact piece, to which one of the limbs of each filament is connected, and two side contact pieces insulated from each other, to which the other limbs of the filaments are connected, the contact pieces lying in the same concentric circle around the central contact piece.

551,364. Magnetic Electric Lamp Holder. Martin H. Collom, Denver, Colo. Application filed June 12, 1895.

The combination is claimed of the lamp, the socket and an electro-magnet in circuit, having its pole or poles exposed and adapted to make contact with magnetic surfaces, whereby the lamp and socket may be placed in contact with, and by means of magnetic attraction may be adjustably and removably suspended from, magnetic surfaces.



NO. 551,371.

551,371. Means for Operating and Regulating Speed of Electric Motors. Rudolf Eickemeyer, Yonkers, N. Y. Application filed December 31, 1892.

The motor is provided with a governing field coil; a governing dynamo is driven by the motor, and a switch for controlling the line current connections with the motor and with the dynamo, and also controlling the delivery of current generated by the dynamo to the governing field coil of the motor.

551,372. Electric Programme Clock. Frederick Frick, Waynesborough, Pa. Application filed April 29, 1895.

A contact spring is provided with a projection, and the stationary contact piece projecting from the base of the machine and arranged under the free end of the spring, a circuit breaker consisting of a disk provided with radial holes and removable pins for depressing the contact spring, and driving mechanism operating to revolve the circuit breaker step by step.

551,391. Automatic Telephone Exchange System. William F. Lounsbury, Owego, N. Y. Application filed April 23, 1895.

An arrangement is described consisting of the combination of a given number of telephones located at respective sub-stations, independent electric conductors connecting each telephone with all the other telephones respectively, a circuit closer in circuit with each of the conductors, and means located at the central station governed by devices located at the sub-stations for controlling the circuit closers in a predetermined manner.

551,427. Heat Regulator. William W. Wilcox, Westerly, R. I. Application filed April 6, 1895.

A movable receptacle for liquid is operatively connected to a heat controlling valve or damper, and there are provided a liquid supply for the receptacle, thermostatic means for controlling the flow of liquid into the receptacle, and distinct thermostatic means for controlling the escape of liquid from the vessel.

551,436. Electric Meter. Thomas Duncan, Fort Wayne, Ind. Application filed July 11, 1895.

Features of the invention are: A vertical spindle carrying an armature and retarding fans, a vertical post adjustable in its bearing and having a jewel setting in a removable or separable part at its upper end, upon which the spindle rotates, and a cup-shaped nut surmounting or covering the jewel and adjustable upon the vertical post.

551,451. Electric Lighter. Herbert E. Rider and John H. Decker, New York, N. Y. Application filed November 10, 1894.

The principal parts in this device are a torch, a receptacle for the same, and an electric spark-forming device, the device being actuated by the withdrawal of the torch to form a spark, but being unaffected by restoring the torch.

551,461. Art of Producing Carbide of Calcium. William C. Clarke, New York, N. Y. Application filed April 29, 1895.

The process consists in causing current to pass between horizontally disposed electrodes embedded in a mass of pulverized and intimately commingled lime and carbon of such extent that a material proportion thereof will remain undecomposed by the passage of the current and gradually separating the electrodes as the material between them is reduced, so as to produce between the electrodes a body of the carbide surrounded by an undecomposed mass of the pulverulent mixture.

551,470. Controlling Electric Motors. David Mason, Schenectady, N. Y. Application filed April 22, 1892.

The combination is claimed of two or more electric motors, a series multiple switching device for controlling the motors, and means for opening the circuit of the armature of one motor while the connections are changing from series to multiple arc.

551,534. Closed Conduit Electric Railway System. Frederick C. Esmond, Brooklyn, N. Y. Application filed April 12, 1895.

The combination includes an insulated supply conductor, working conductor sections, switches and magnets for operating the switches, with a double set of overlapping collectors leading to the motor, and a switch for including a resistance in the circuit between the motor and the rear set of collectors in either direction of motion of the car.

551,536. Closed Conduit Electric Railway System. Frederick C. Esmond, Brooklyn, N. Y. Application filed April 26, 1895.

The combination is claimed of a supply conductor, working conductor sections or points arranged in sets of three, double collectors and a battery or other source of current adapted to be connected to the different collectors.

551,537. Closed Conduit System for Electric Railways. Frederick C. Esmond, Brooklyn, N. Y. Application filed September 11, 1895.

Features of the invention are: An insulated supply conductor, a series of working contact sections normally disconnected from the supply conductor, a series of switches for connecting the contact sections with the supply conductor, and a series of electro-magnets for operating the switches whose coils are connected at an intermediate point in such manner as to form a path for current through only a portion of the magnet coils.

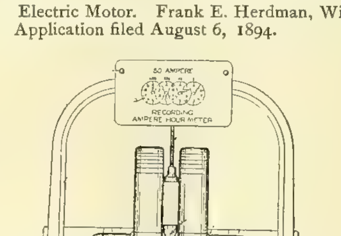
551,567. Electric Motor. Merle J. Wightman and Oscar C. G. Urban, Cleveland, O. Application filed May 16, 1893.

An electric motor is described, having a pole-piece constructed in two sections, the rearward or outer section whereof is removable, whereby the inner section is capable of being moved outwardly or backwardly from the armature.

551,587. Electric Railway. Rudolph M. Hunter, Philadelphia, Pa. Application filed February 23, 1887.

An electrically propelled vehicle is combined with an electric motor, made substantially cylindrical and supported directly by the axle independent of and between the wheels, and a commutator and brushes for the field magnets and armature.

551,633. Electric Motor. Frank E. Herdman, Winnetka, Ill. Application filed August 6, 1894.



NO. 551,436.

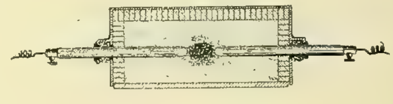
An electric motor, a source of current supply, electrical connection between the fields and current source, a weighted arm adapted in its movement in one direction to decrease the amount of current in the field, and in the other direction to increase the current in the field, a bar connected to the weighted arm provided with flanged ends, an operating bar and a bell-crank, one end connected to the operating bar, the other end being provided with a roller adapted to rest adjacent to the flange of the bar.

551,634. Mechanism for Admission and Regulation of Currents to Motors. Frank E. Herdman, Winnetka, Ill. Application filed March 29, 1895.

In combination with a source of current supply a translating device is employed, together with circuit connections to the translating device, a switch for controlling the admission of current to the translating device, and operating mechanism for controlling the switch, a device adapted in its movement to vary the current strength in the circuit to the translating device, actuating mechanism adapted to move the device in one direction, and mechanism connected with the operating mechanism, adapted by the movement of the operating mechanism to move the actuating mechanism and the current varying device in the other direction.

551,635. Mechanism for Admission of Currents to Motors and Regulation of Currents in Same. Frank E. Herdman, Winnetka, Ill. Application filed June 28, 1895.

One claim is given: In combination with a source of current supply, a translating device and circuit connections to said translating device, of a device adapted in its movement to vary the current strength in the circuit to the translating device, a solenoid, connection between the current regulating device and core of the solenoid, an operating bar, a crank upon said bar, an arm, a slot and pin or equivalent connection between said arm and crank, and connection between said arm and the solenoid core, spring contacts connected with said current varying device in the circuit to the solenoid, said contacts being normally closed and controlled by the action of the pin and walls of the slot, and wire connection between said contacts, including resistances.



NO. 551,461.

551,664. Electric Railway Motor Shield. Isaac F. Baker and William R. McLain, Lynn, Mass. Application filed November 25, 1889.

A propelling electric motor is sustained or supported beneath the body of the car, and a protective pan or shield is formed in jointed sections and sustained between the motor and the ground, and suitable fastening devices for detachably securing the free end of the pan in elevated position are provided.

551,674. Telephone Transmitter. Theodore Grissinger, Mechanicsburg, Pa. Application filed October 18, 1894.

There are a granulated conducting medium, a vibrator adapted to agitate the conducting medium in accordance with sound vibrations, a casing for the conducting medium and vibrator, and means for conducting an electric current laterally through the granulated conducting medium, and at a right angle to the movements of the vibrator.

551,682. Electric Lock. Philip Meyer and Julius A. Meyer, Newark, N. J. Application filed February 23, 1895.

This lock combines with the case a bolt head pivoted inside the case and projecting outward therefrom, an armature lever linked to the pivoted bolt head to turn the same inward when the magnet is energized, and an electro-magnet arranged within the case, all the parts being arranged and operating.

551,712. Dynamo-electric Machine. Alexander B. Blackburn and William Buchanan, Wolverhampton, Eng. Application filed October 1, 1895.

An exciting coil is combined with two or more armature coils, and sets of laminated magnetic material, some embracing one armature coil and some another, and an inductor having projections to close the magnetic circuits successively, whereby there is little or no fluctuation in the number of lines through the exciting coil.

551,734. Transmission of Electricity to Moving Cars. Thomas Nesom, Indianapolis, Ind. Application filed September 21, 1894.

In a system for transmitting electricity to a moving car there are employed a box containing feed wires, a conduit holder placed above such box in sections, an insulating block between such sections, a conduit in such conduit holder, a line conductor within such conduit, and connecting wires from the feed wires extending through such insulating blocks to the line conductor.

551,743. System for Regulating Effective Tension of Electrical Circuits. Hermann O. W. J. Breul, Berlin, Germany. Application filed November 17, 1893.

There is claimed the combination with a consumption circuit of a number of feeding conductors connected therewith, means for increasing or decreasing the electromotive force impressed upon the several feeding conductors, and a device responsive to the reversal of current in a feeding conductor.

# Western Electrician.

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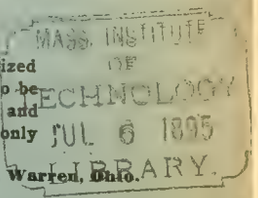


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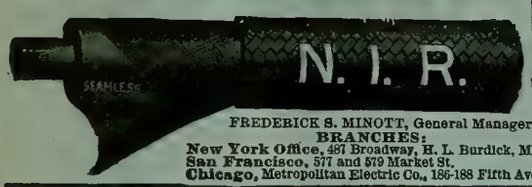


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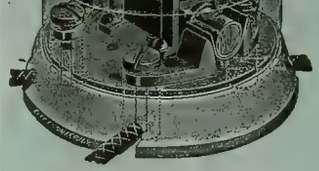

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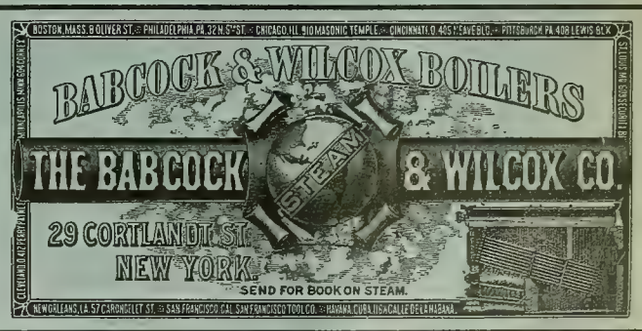


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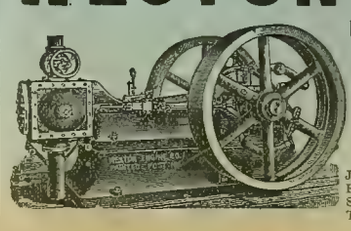

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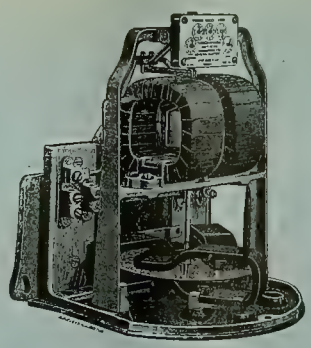

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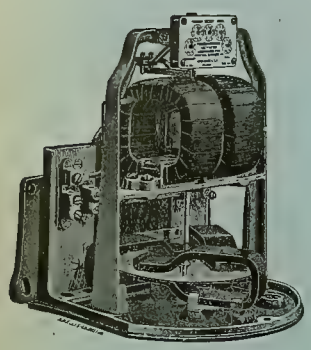

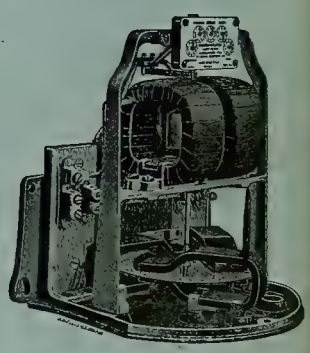

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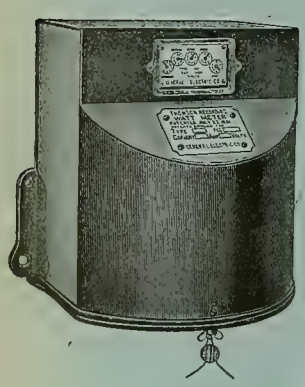

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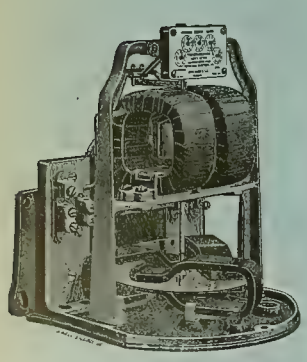

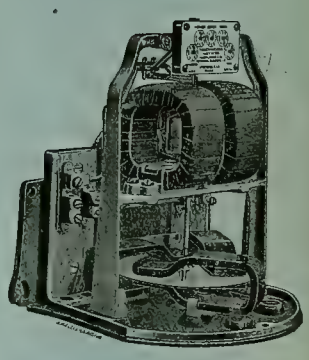

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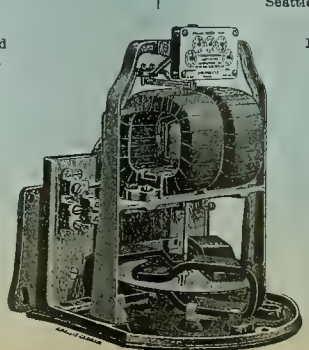

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Bradbury-Stone Elec. S. Co
Electric-Power Storage Co.
Electric Storage Battery Co.
Porter & Buerdorf.

**Annunciators.**
Central Electric Co.
Dearborn Electric Co.
Electric Appliance Co.
Ostrander & Co., W. R.
Partrick & Carter Co.

**Arc Lamps.**
C & C Electric Co.
Central Electric Co.
Corey, R. B.
Crocker-Wheeler Elec. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Helios Electric Co.
Little, F. P. Elec. C. & S. Co.
Parker & Grover, Receivers.
Perkins El. Switch Mfg. Co.
Standard Electric Co.
Standard Thermometer Co.
Westinghouse El. & Mfg. Co.

**Arc Light Cord.**
Samson Cordage Wks.

**Batteries and Jars.**
Andrae & Sons, J.
Boswell & Co., D. E.
Boynton Multivolt Batt'y Co.
Bradbury-Stone Elec. S. Co.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Central Electric Co.
Dearborn Electric Co.
Edgerton Pottery Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Hemingray Glass Co.
Leclanche Battery Co., The.
Miamisburg Electric Co.
Newton Rubber Wks.
Partrick & Carter Co.
Western Electric Co.

**Bells.**
Andrae & Sons, J.
Central Electric Co.
Dearborn Electric Co.
Electric Appliance Co.
Gillette, E. & F.
Huebel & Manger
Ostrander & Co., W. R.
Partrick & Carter Co
Western Electric Co.

**Belting.**
Shultz Belting Co.

**Boilers.**
Abendroth & Root Mfg. Co.
Babcock & Wilcox Co., The.
Campbell & Zell.
Clonbrock Steam Boiler Co.
Erie City Iron Wks.
Fraser & Chalmers.
Fulton Steam Boiler Wks.
Moyes, L. M.
Racine Hardware Co.
Stirling Co., The.
Weston Engine Co.

**Books, Electrical.**
Electrician Publishing Co.

**Bronze.**
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co., Ltd.

**Brushes.**
Belknap Motor Co.
Boudreaux Dyn. Brush Co.
Central Electric Co.
Partridge Carbon Co.

**Burglar Alarms.**
Central Electric Co.
Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

**Cables** (See Insulated Wires.)

**Cables, Electric** (See Insulated Wires), **Copper, Sheet and Bar.**
American Elec. Works.
Brixey, W. R.
Central Electric Co.
Chicago Ins. Wire Co.
Dearborn Electric Co.
Eastern Electric Cable Co.
Elec. Engr. & Supply Co.
Moore, Alfred F.
New York Ins. Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Western Electric Co.

**Carbons, Points & Plates.**
Central Electric Co.
Corey, R. B.
DeRonde & Co., A.
General Electric Co.
Partridge Carbon Co.
Reisinger, Hugo.
Wertheim, Ed.
Western Electric Co.

**Carriages and Buggies.**
Henney Buggy Co.

**Clocks, Watchmen's.**
Southgate & Co., W. B.

**Compound.**
Standard Paint Co.
Tornberg, Edw. R.

**Conduits.**
Central Electric Co.
Interior Conduit & Ins. Co.
National Conduit Mfg. Co.

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Crocker-Wheeler Elec. Co.
Ft. Wayne Elec. Corporation
Interstate Com. El. Const. Co.

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Brush Electric Co.
Bryan, Wm. H.
C & C Electric Co
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Fontaine Crossing & El. Co.
Ft Wayne Elec. Corporation.
General Electric Co.
Goltz & Sinclair.
Interior Conduit & Ins. Co.
Siemens & Halske Elec. Co.
Standard Electric Co.
United Elec Improvement Co
Walkins, Louis E.
Westinghouse Elec & Mfg. Co.
Western Electric Co.
Woods & Co., C. E.

**Copper.**
Besly & Co., Chas. H.
Miamisburg Electric Co.

**Copper Wire Rought**
Besly & Co., Chas. H.
Brixey, W. R.
Bunnell & Co., J. H.
Central Electric Co.
Dearborn Electric Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.
National India Rubber Co.
Okonite Co. The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Western Electric Co.

**Cordage.**
Samson Cordage Wks.

**Cranes.**
Harrington, Son & Co , E.

**Cross-Arms, Pins and Brackets.**
Anderson, Albert & J. M.
Brady, T. H.
Brodie Electric Co.
Central Electric Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Nuttall Co., R. D.
Partrick & Carter Co.

**Cut-Outs and Switches.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Brodie Electric Co.
Bryant Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Edison Co.
Colgate Co., Geo. L.
Crocker-Wheeler Elec. Co.
Cutter Electrical & Mfg. Co.
Dearborn Electric Co.
Diamond Electric Co.
Eddy Elec. Mfg. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric Protection Co.
Elec. Selec. & Signal Co.
Emerson Elec. Mfg. Co.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Forest City Elec. Wks.
Forsyth & Fisk.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hart & Hegeman Mfg. Co.
Huebel & Manger.
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Louisville Elec. Works.
Nuttall Co., R. D.
Partrick & Carter Co.
Perkins El. Switch Mfg. Co.
Platt, O. S.
Wagner Elec. Mfg. Co.

**Dynamos.**
Brush Electric Co.
C & C Electric Co.
Central Electric Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Elliott-Lincoln Elec. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Roth Bros. & Co.
Royal Electric Co.
Siemens & Halske Elec. Co.
Standard Electric Co.
Walker Mfg. Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

**Economizers.**
Fuel Economizer Co.

**Electric Railways.**
Brush Electric Co.
General Electric Co.
Siemens & Halske Elec. Co.
Westinghouse El. & Mfg. Co.

**Electrical and Mechanical Engineers.**
Arnold, B. J.
Bain, Foree.
Bryan, Wm. H
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Ford, Owen.
Goltz & Sinclair.
Thayer Electric Co.
Walkins, Louis E.
Woods & Co., C. E.

**Electrical Instruments.**
Anderson, Albert & J. M.
Brodie Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Dearborn Electric Co.
Diamond Electric Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Interior Conduit & Ins. Co.
Nuttall Co., R. D.
Partrick & Carter Co.
Platt, O. S.
Queen & Co. Inc.
Weston Elec. Inst. Co.

**Electrical Specialties.**
Allen, L. B.
Clark El. Specialty Mfg. Co.
Electric Protection Co.
Interstate Com. El. Const Co.
N. Y. Elec. Wks
S. K. C. Specialty Co.

**Electrolliers, etc.**
Edwards, W. S. Mfg. Co.

**Electro-Plating Mach'y.**
Besly & Co., Chas. H.
General Electric Co.

**Engines, Gas.**
Otto Gas Engine Wks.

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Chuse & Co., J. F.
Erie City Iron Wks.
Fraser & Chalmers.
Racine Hardware Co.
Westinghouse Machine Co.
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Central Electric Co.
Diehl & Co.
Dieterichs-Warwick El Co
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Whitmore-Dean Mfg. Co.

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Vulcanized Fibre Co.

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Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.

**Gas Lighting, Electric.**
Partrick & Carter Co.

**Gears.**
Besly & Co., Chas. H.
Nuttall Co., R. D.

**General Elec. Supplies.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Besly & Co., Chas. H.
Brodie Electric Co.
Bryant Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Edison Co.
Colgate Co., Geo. L.
Cutter Electrical & Mfg. Co.
Dearborn Electric Co.
Dieterichs-Warwick El. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric Protection Co.
Elliott-Lincoln Elec. Co.
Emerson Elec. Mfg. Co.
Farr Tel. & Const. Supply Co.
Forest City Elec. Wks.
Garton-Daniels Elec. Co.
General Electric Co
Goltz & Sinclair.
Hayes, Fyfe Co.
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Louisville Elec. Works.
Metropolitan Electric Co.
Morris & MacCurdy.
N. Y. Elec. Wks
Partrick & Carter Co.
Perkins El. Switch Mfg. Co.
Platt, O. S.
Queen & Co. Inc.
Sioux City Brass Works.
S. K. C. Specialty Co.
Standard Tel. & Elec. Co.
Thayer Electric Co.

**Globes and Electrical Glassware.**
Edgerton Pottery Co.
Edwards, W. S. Mfg. Co.
Hemingray Glass Co.

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Besly & Co., Chas. H.
Dixon Crucible Co., Jos.

**Hard Rubber Goods.**
Butler Hard Rubber Co.
Fiberite Co., The.
Newton Rubber Wks.

**Insulators and Insulating Materials.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Brixey, W. R.
Brodie Electric Co.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
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Chicago Ins. Wire Co.
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Dearborn Electric Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
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Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Hart & Hegeman Mfg. Co.
Hemingray Glass Co.
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Johns Mfg. Co., H. W.
Little, F. P. Elec. C. & S. Co.
Munsell & Co., Eugene.
National India Rubber Co.
Newton Rubber Wks.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Platt, O. S.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Paint Co.
Standard Underground C. Co.

**Insulated Wires and Cables—Magnet Wire.**
American Electrical Works.
Brixey, W. R.
Brodie Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Ins. Wire Co.
Dearborn Electric Co.
Eastern Electric Cable Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
General Electric Co.
Independent Electric Co.
Louisville Elec. Works.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Safety Ins. Wire & Cable Co
Simplex Electrical Co.
Standard Underground C. Co.

**Lamps, Incandescent.**
Am. Electrical Mfg. Co.
Buckeye Electric Co.
Central Electric Co.
Columbia Inc. Lamp Co.
Dearborn Electric Co
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Globe Electric Light Co.
New York & Ohio Co.
Partrick & Carter Co.
United Elec. Imp. Co.
Westinghouse Elec. & Mfg Co.

**Lightning Arresters.**
Colgate Co , Geo. L.
Diamond Electric Co.
Electric Appliance Co.
General Electric Co.
Garton-Daniels Elec. Co.

**Magnet Wire.**
(See Insulated Wires.)

**Mechanical Machinery**
Besly & Co., Chas. H.
Harrington, Son & Co., E.
Lukens Iron & Steel Co.

**Mica.**
Johns Mfg. Co., H. W.
Munsell & Co. Eugene.

**Mining Apparatus, Elec.**
General Electric Co.

**Motors.**
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Belknap Motor Co.
Brush Electric Co.
C & C Electric Co.
Central Electric Co.
Crocker-Wheeler Elec. Co.
Dieterichs-Warwick El. Co.
Eddy Elec. Mfg. Co.
Elec. Engr. & Supply Co
Elliott-Lincoln Elec. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Louisville Elec. Works.
Roth Bros. & Co.
Royal Electric Co.
Sioux City Brass Works.
Standard Electric Co.
Stanley Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
Walker Mfg. Co.
Westinghouse El. & Mfg. Co.

**Packing.**
Besly & Co., Chas. H.
Garlock Packing Co.

**Paints.**
Morris & MacCurdy.
Standard Paint Co.

**Patents.**
Gooch, Chas. J.

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Phosphor Bronze Sm. Co. Ltd

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**Platinum.**
Baker & Co.

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Morris, Tasker & Co.
Nuttall Co., R. D.
Valentine-Clark Co.

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Empire China Works.
General Electric Co.
Hemingray Glass Co.

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Electrician Publishing Co.

**Push Buttons.**
Central Electric Co.
Electric Appliance Co
Partrick & Carter Co.

**Rheostats.**
Central Electric Co.
General Electric Co.
Hayes, Fyfe Co.

**Sal Ammoniac.**
Klipstein & Co., A.

**Silk Braid.**
Boston Braid Mfg. Co.

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Electric Appliance Co.
Ostrander & Co., W. R
Partrick & Carter Co

**Speed Indicators.**
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Colgate Co., Geo. L.
Diamond Electric Co.
Queen & Co. Inc.
Weston Elec. Inst. Co.

**Steam Heating.**
Goubert Mfg. Co.
Webster & Co., Warren.
Whitmore-Dean Mfg. Co.

**Storage Batteries.**
Boswell & Co., D. E.
Bradbury-Stone Elec. S. Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Porter & Buerdorf.

**Street Cars.**
Brill, J. G. Co.

**Tapes, Insulating.**
American Electrical Works
Brixey, W. R
Central Electric Co.
Chicago Ins. Wire Co.
Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Paint Co.

**Telegraph Apparatus.**
Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

**Telephones and Telephone Material.**
Andrae & Sons, J.
Central Electric Co.
Farr Tel. & Const. Supply Co.
Forsyth & Fisk.
Gillette, E. & F.
Gustafson, W. A.
Mo Telephone Mfg. Co
Partrick & Carter Co.
Phila. Telephone Co.
Public Telephone Co.
Standard Tel. & Elec. Co.
U. S Tel. Const. Co.
Universal Telephone Co.
Western Electric Co.
Western Tel. Const. Co.

**Transformers.**
Central Electric Co.
Diamond Electric Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hornberger Elec. Mfg. Co.
Louisville Elec. Works.
Royal Electric Co.
Stanley Electric Mfg. Co.
Wagner Elec. Mfg. Co.

**Trolley Cord.**
Samson Cordage Wks.

**Trucks, Electric Car.**
General Electric Co.
Westinghouse El. & Mfg. Co.

**Turbine Wheels.**
Dayton Globe Iron Works Co.
Leffel & Co., Jas.
Smith, S. Morgan.
Stillwell-Bierce & Smith-Vaile Co.

**Universities.**
Chi. Shorthand Institute.
Int. Corr. Schools.
Rose Poly. Institute.

**Water Wheels.**
Leffel & Co., Jas
Smith, S. Morgan.

**Wire, Bare.**
Anderson, Albert & J. M.
Besly & Co., Chas. H.
Bishop Gutta Percha Co.
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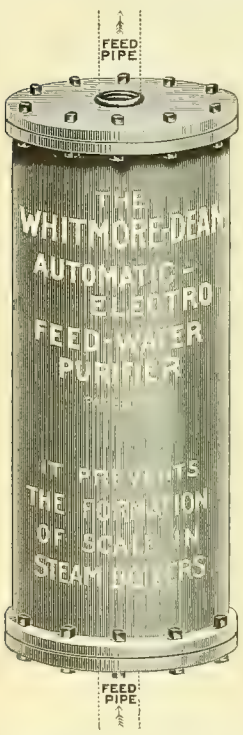


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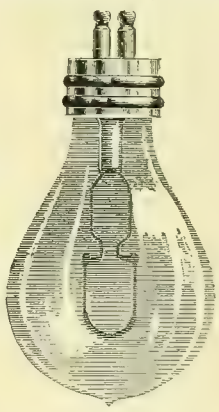

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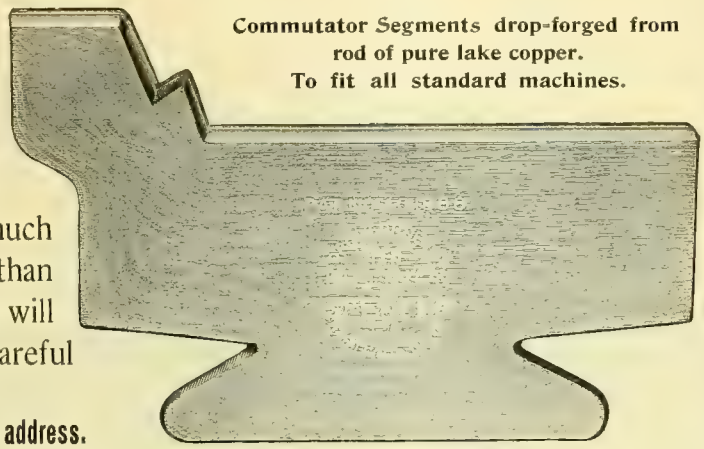
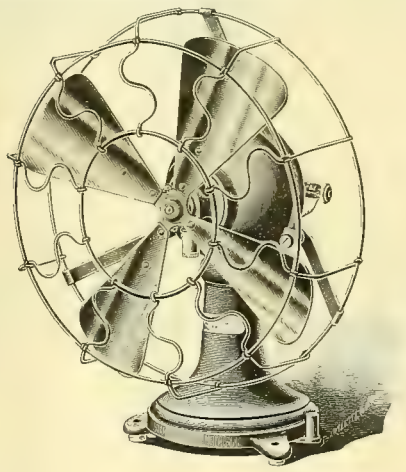
**Commutator Segments drop-forged from rod of pure lake copper. To fit all standard machines.**



**The eleventh hour** is a good time to order the **twelfth Motor,** and there's no better time than **July** to sell it. Are you going to complete the dozen and reap the benefit? Remember we can ship the same day you order.



OKONITE IT NEVER DISAPPOINTS

OKONITE IT NEVER DISAPPOINTS

# Central Electric Company,

## 173-175 Adams St.,

**Interior Conduit.** CHICAGO. **Pharos Lamps.**

BRANCHES: { Kansas City, Mo.: Gate City Electric Co.
{ St. Louis: Southern Electric Supply Co.


### Heaven is Reached by Stages.

**Burcham Harding Tells the Theosophical Society What Happens After Death**

The other evening Burcham Harding addressed a meeting at the rooms of the Loyalty branch of the Theosophical Society, No. 15 Washington Street. His subject was, "What Happens After Death?" He said in part:

"When we get rid of the physical body we pass into Kama-loca, where is the second death, the death of the lower nature. It is the selfish and the animal that we must drop into Kama-loca, while the unselfish passes into a higher state. The stay in Kama-loca is necessary to get rid of our lower nature, which may be described as the intellectual animal. Passions, hatreds, selfishness of all kinds are lived over in Kama-loca, but with this difference, they have nobody by which to express them and they gradually die out. When the second death has taken taken place the now freed soul passes up to Devachan, or heaven. There it is the higher mind is conscious. We are told that the period between two incarnations varies greatly from a few months to 1,000 or 1,500 years."

---

CHICAGO continues to amaze us with her ingenious census figures. Gradually she is swelling herself towards the 2,000,000 mark. But, O Chicago! it is time wasted. Even should you leave this city's population far behind in numbers—which you probably will never do—you would not be New York. Figures are unimportant in some things, O Chicago! The centipede is not as great as the race horse, although he has twenty-five times as many legs. When you have done your counting ask yourself how many Chicago men it takes to make a New York man and you will realize how vain your arithmetic is.—New York World.

The reader is requested to notice the unmistakable undertone of sadness that pervades the foregoing in spite of its assumption of hilarity.

---

### Didn't Like It.

*Tankley*: Goggins sent me a bottle yesterday, containing a snake preserved in alcohol.

*Grimes*: Think he ment to insult you?

*Tankley*: I don't know, but I certainly do not appreciate the gift nor the spirit in which it was tendered.

---

### Renewal of Sectional Bitterness.

Texan (at the grocery store)—"What do you call them things?"

Grocer—"Those are olives."

"Are they good to eat?"

"Certainly. Try one of them."

(Bites into one) "Jest as I expected. Got a wooden core. Come from Connecticut, don't they?"—Tribune.

---

### Same Old, Old Story.

"I proposed to Miss Gladys Beautigirl last night."

"Ah! and she accepted you?"

"Well no—o—o, not exactly, but she came so near doing so that a great deal of the sting was taken out of her refusal. She said she would have accepted me if I had had plenty of money and a perfect disposition, and my eyes were brown instead of blue, and my hair curly, and I was two inches taller, and was winning fame in my profession, and possessed personal magnetism, and came from an old and blue-blooded family, and would always let her have her own way, and never smoked nor wanted to stay out late at night, and did not belong to any lodge, and would keep a stylish turnout and plenty of servants, and really wanted her mamma to live with us, and a few other things which I have forgotten. But if a fellow must fail in an undertaking, it is encouraging to him to think that he came very near winning."—Harper's Bazar.

---

### I Ought To and I Will.

Strange lack of connection generally between these two points! The electric button of commerce is touched, and in an instant New York responds to San Francisco. We have cultivated our machinery, but the prompt action of our wills we have not improved. To the well trained man the thought "I ought to" should instantly arouse the determination "I will."

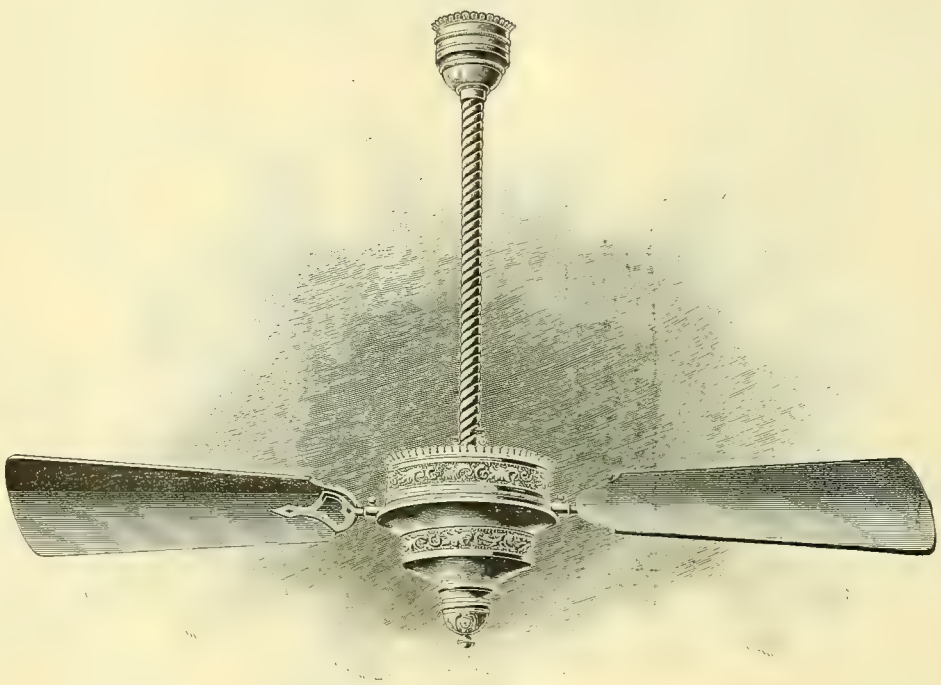
A resolution grows rusty when it is not used Every time that hesitation arises between these two points the machinery of the will suffers; the delays lengthen with each neglect, and the whole character is weakened.

# THE NEW DIEHL ELECTRIC CEILING FAN,

## JUST PERFECTED.

Increased Efficiency, with a saving of 25 per cent in use of current required.

New and attractive designs.



Improved Mechanical Construction, including a New and Thoroughly Effective oiling device.

Wound for 110, 125, 170, 220, 250, 500 Volts,

## DIRECT INCANDESCENT

OR

## ANY DIRECT ARC CURRENT.

## DIEHL & COMPANY, - 385 Broadway, - NEW YORK.

# Will You Be In It? Yes!

## USE THE BOUDREAUX DYNAMO BRUSH.

The Boudreaux Dynamo Brush Co. NO GAUZE.

The Boudreaux Dynamo Brush Co. NO CARBON.

EACH LAYER OF THIS ANTI-FRICTION METAL

1-1250 PART OF 1 INCH THICK.

NO SPARKING. NO CUTTING.

NO TRIMMING. NO GREASING.

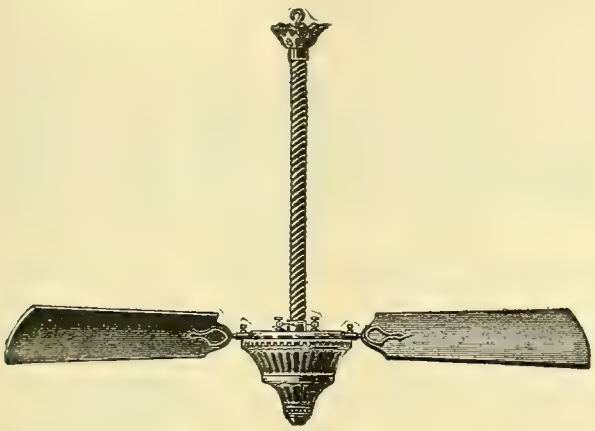
The Boudreaux Dynamo Brush Co. NO WOVEN WIRE.

The Boudreaux Dynamo Brush Co. NO COPPER.

**THE BOUDREAUX DYNAMO BRUSH CO.,**

Mallers Building, CHICAGO. Postal Te'egraph Building, NEW YORK.

Sole Agent for Canada, R. E. T. PRINGLE, Montreal, Que. Sole Agent for New England States, ALTON D. ADAMS, Boston.
Sole Agents for the Pacific Coast, J. W. BROOKS & CO., 120 Sutter St., San Francisco, Cal.



**AN EMPHATIC SUCCESS!**
**THE DIEHL ELECTRIC FANS WIRED IN A SERIES OF TWO OR MORE ON A STREET RAILWAY CURRENT.**

**DIEHL & COMPANY, 385 BROADWAY, NEW YORK.**

# BUCKEYE

QUALITY UNEQUALED.

FACTORY PRODUCTION TRIPLED.

## INCANDESCENT LAMPS

Monadnock Building, Chicago. **THE BUCKEYE ELECTRIC CO., Cleveland, O.**

# EDDY GENERATORS.

Direct Connected or Belted for Electric Railways, Central Stations, Isolated Lighting or Power Plants.

## EDDY MOTORS—SLOW, MEDIUM OR HIGH SPEED.

*We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.*

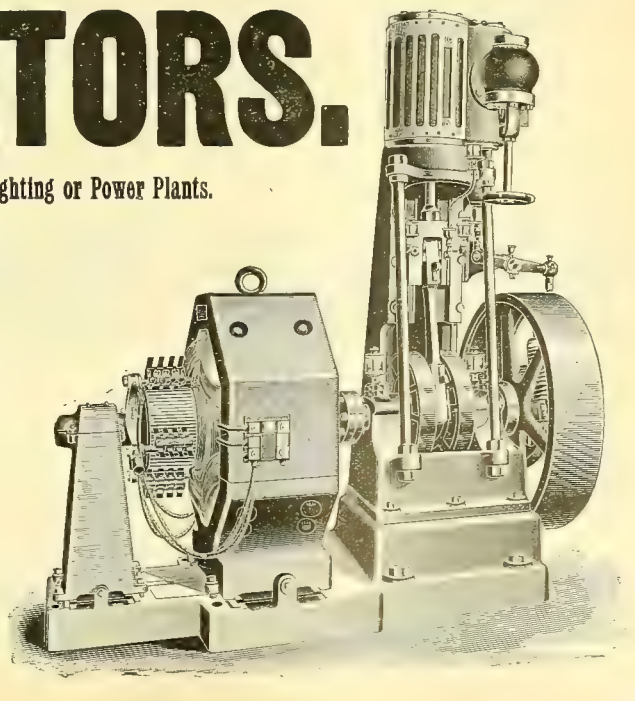
## THE EDDY ELECTRIC MFG. CO.,

*WINDSOR, CONN.*

**NEW YORK OFFICE, HAVEMEYER BLDG.**

*REPRESENTED BY:*

**Walter C. McIntire & Co., 506 Commerce St., Philadelphia, Pa.**
**Western Electrical Supply Company, St. Louis, Mo.**
**F. P. Little Electrical Construction & Supply Co., Buffalo, N. Y**
**W. T. Osborn, Kansas City, Mo.**
**D. P. GOSLINE, 30 Oliver St., Boston, Mass.**



**All Our Apparatus Guaranteed as Represented.**

# THE PIONEERS

AND STILL

# THE FOREMOST

IN THE DEVELOPMENT OF THE

## ELECTRICAL RAILWAY

FOR

City Railroads, Elevated Railroads
Interurban Railroads, and Trunk Lines.

THE EXCLUSIVE STAMP OF SUPERIORITY IS ON OUR

RAILWAY { GENERATORS, MOTORS, CONTROLLERS AND ALL OUR SUPPLIES.

70 per cent. of the total number of Electric Railways and over 65 per cent. of the total Electric Railway Mileage in the United States, are operated exclusively by General Electric Company's apparatus.

# GENERAL ELECTRIC COMPANY,

MAIN OFFICE, SCHENECTADY, N. Y.

**SALES OFFICES:**

Boston, Mass., 180 Summer Street.
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Syracuse, N. Y., Sedgwick, Andrews & Kennedy Bldg.
Buffalo, N. Y., Erie County Savings Bank Building.
Philadelphia, Pa., 509 Arch Street.
Baltimore, Md., 227 East German Street.
Pittsburg, Pa., Times Building.
Atlanta, Ga., Equitable Building.
Cincinnati, Ohio, 420 West Fourth Street.
Columbus, Ohio, 14 North High Street.
Nashville, Tenn., 308 North Summer Street.
Chicago, Ill., Monadnock Building.
Detroit, Mich., 13 Rowland Street.
Omaha, Neb., 309 South 13th Street.
Kansas City, Mo., New York Life Building.
St. Louis, Mo., Wainwright Building.
Dallas, Tex., Corner Elm and Griffin Streets.
Helena, Mont., Electric Building.
Denver, Colo., 505 16th St.
San Francisco, Cal., 15 First Street.
Portland, Ore., Front and Ankeny Streets.
Seattle, Washington, Bailey Building.

For all business outside the United States and Canada: Foreign Dept, Schenectady, N. Y., and 44 Broad Street, N. Y.

For Canada, address Canadian General Electric Company, Ltd., Toronto, Canada.

# THE SAFETY INSULATED WIRE & CABLE COMPANY,

**LEONARD F. REQUA, General Manager,**

**225-239 WEST 28TH ST., NEW YORK.**

MANUFACTURERS OF

# SUBMARINE CABLES

OF ALL SIZES AND DESCRIPTIONS.

## "SAFETY" NAVY MARINE WIRES AND CABLES

used exclusively on the U. S. War Vessels:

NEW YORK, CINCINNATI, TEXAS, RALEIGH, BANCROFT, MARBLEHEAD, MIANTONOMAH, COLUMBIA, OLYMPIA, OREGON, MINNEAPOLIS, INDIANA, MASSACHUSETTS, ST. LOUIS and ST. PAUL.

## ELECTRIC RAILWAY FEEDER WIRES.

80 miles of rubber and lead encased 1,000,000 C. M. has been furnished by us to People's Traction Company of Philadelphia.
60 miles same type cables now being furnished by us to the West Chicago Street Railway Company.

## "SAFETY" UNDERGROUND CABLES.

Over 1600 miles of rubber covered and lead encased now in use in New York and other Cities.

## "REQUA WHITE CORE" AND "SAFETY" WIRE.

For Office Buildings, Dwellings, Mills, etc.
All these wires are made with a view to perfect safety for Electric Lighting.

M. B. AUSTIN, Agent Chicago Office, 1533 MONADNOCK BLOCK.

# SIEMENS & HALSKE

# ELECTRIC COMPANY

**Siemens & Halske.**
Berlin,
Charlottenburg,
Vienna,
St. Petersburg.

## OF AMERICA,

**Manufacturers of**

## DIRECT CURRENT SLOW SPEED

# Multipolar Generators and Motors.

These machines are constructed with ***external armatures.*** They have proved remarkably efficient and economical. Used largely in American and European Lighting and Railway Plants. Slow speed machines, made for direct-connection in sizes from 20 H. P. to 2,000 H. P.

### ADVANTAGES OF OUR EXTERNAL ARMATURE TYPE.

Maximum peripheral speed of armature with slowest engine speed. Shortest possible winding on armature. Lowest internal resistance of Armature. Only three to four volts difference of potential between commutator bars. Greatest weight of copper per ampere of current. Greatest radiating surface possible. Maximum magnetic effect. Armatures cannot burn out. Great compactness. Correct mechanical design. (The centrifugal force is counteracted effectively by the inward pull of the internal field magnets.) Finest quality of iron, excellent finish, absence of binding wire. ***In 8 years' continuous service not one armature has been replaced or repaired.***

### OVER 200,000 H. P. IN USE

***For Railway, Lighting and Motor Service.*** World's Fair Diploma and Medal for ***best*** direct-connected Generator.

# MODERATE SPEED BIPOLAR GENERATORS AND MOTORS,

With Siemens Drum Armatures, which are copied extensively in this country. We are building these machines in sizes from 1 H. P. to 150 H. P.

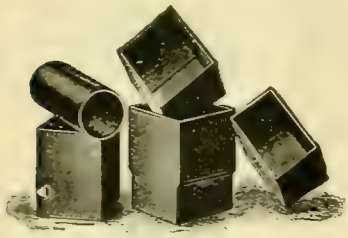
**SEE OUR NEW CATALOGUES. CORRESPONDENCE SOLICITED.**

---

## GENERAL OFFICES, MONADNOCK BUILDING, CHICAGO.

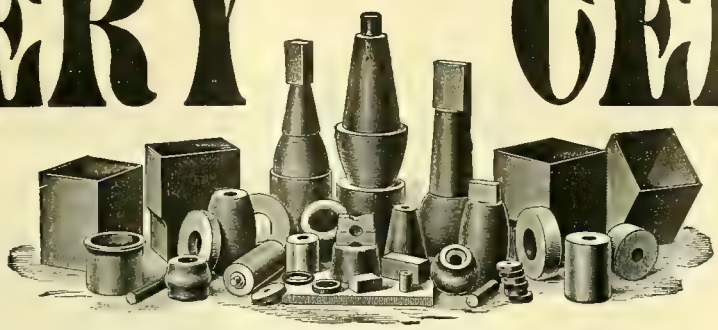
Sales Offices:

New York, 136 Liberty St.
Cincinnati, Perin Bldg.
Troy, N. Y., 43 Fourth St.
Philadelphia, 531 Chestnut St.,
St. Louis, Bank of Commerce Bldg.
San Francisco, 508 California St.
Toledo, Ohio, 518 Summitt St.
Boston, 31 Milk St.
Denver, 608 Boston Block.
Detroit, 47 State St.
Buffalo, N. Y., Erie Co. Bank Bldg.
Minneapolis, 249 Second Avenue S.
Salt Lake City, Knutsford Hotel Bldg.



# THE FREEMAN

# BATTERY CELLS.



Estimates Furnished on Application. Prompt Delivery.

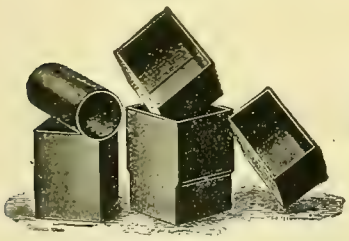
Standard Sizes Always on Hand.

The composition used in the manufacture of these battery cells makes them positively acid-proof, which result has never before been accomplihsed providing additional strength to such an extent that this cell can be used where no other would be practical.

## THESE CELLS ARE A NEW PRODUCTION AND FULLY GUARANTEED.

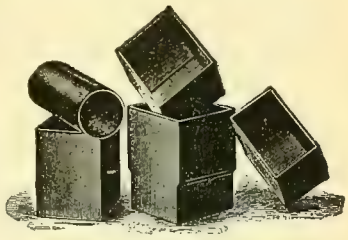
**AGENTS WANTED IN ALL CITIES.** **WRITE US FOR INFORMATION AND CATALOGUE.**

THE



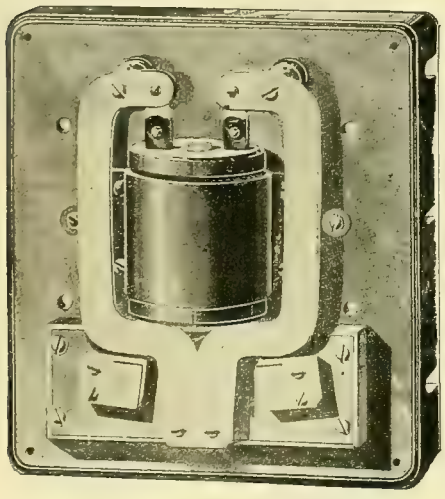
## Newton Rubber Works,

Newton Upper Falls, Mass.



## SINCE MARCH 1st

## Our New (Model 1895) Electric Light and Power Controllers



HAVE BEEN ADOPTED BY CENTRAL STATIONS OPERATING

**5,000** ARC LAMPS AND **60,000** INCANDESCENTS.

They are the Only System which will Cut $\frac{On}{Out}$ your Motors, Arc Lights, Converters, Transformers, from your Central Station.

OUR GENERAL WESTERN AGENTS ARE

## WALLACE ELECTRIC CO., 305 DEARBORN ST., CHICAGO.

## ELECTRIC SELECTOR & SIGNAL CO. 45 Broadway, New York.

# INCANDESCENT LAMPS.

WE MANUFACTURE THE "GLOBE." LIFE AND EFFICIENCY GUARANTEED.

New Process of Exhaustion by Mechanical Vacuum Pump. Absolutely Dry Vacuum. Samples and Prices Furnished on Application. Correspondence Solicited.

## GLOBE ELECTRIC LIGHT CO., 6 Clifton St., ROXBURY, MASS.

AGENTS WANTED. WRITE US.

## HELIOS ELECTRIC COMPANY,

**Factory and Offices,**

**1310 Filbert Street, Philadelphia, Pa.**

***We have no Stock nor Old Style Lamps that we must get rid of at any price—no junk.***

### THE HELIOS LAMPS

Are the latest patterns and newest type. Our Lamps are much in advance of any lamp now on the market, because they are New and of Latest Designs.

Our ALTERNATING LAMPS have Reflector Plates. Our DIRECT CURRENT Lamps do not see-saw. Our Focusing Lamps, both Direct and Alternating, are especially adapted for photo-engraving and stereopticon work.

**Anchor Electric Co.**, New England Agents, Boston, Mass.
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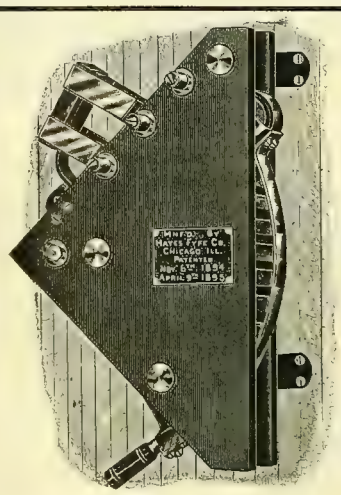
**Moore & Baylis**, Agents for Western New York, Buffalo, N. Y.,
**Globe Electrical Supply & Construction Co.**, New York City Agents, Vandam and Greenwich Streets, New York.
**Mountain Electric Co.**, Agents for Colorado, Utah, Wyoming and New Mexico, Denver, Col.
**Machinery Supply Co.**, Agents for Southern California and Arizona, Los Angeles, Cal.
**W. T. M. Mottram**, Agent for Texas, Dallas, Tex.
**Canadian General Electric Co.**, Canadian Agents, Toronto, Canada.
**California Electrical Works**, San Francisco, Cal.




**Automatic in Release with D. P. Switch.**

## THE FYFE RHEOSTAT

(For Regulating and Saving Motors)

Is Automatic in Release from any Point of the Resistance.

Made with and without D. P. Switch.
Guaranteed Firepoof.
Made Any Required Size.
Costs No More than the Old Styles.

Write or Call for Information.

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MANUFACTURERS,

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Corner Dearborn and Harrison Streets.

## "J. P." STYLES of TROLLEY HANGERS.

Strong and Light,
Highest Grade Workmanship and Material.

**Moulded Mica Insulation.** **Vulcabeston Controller Parts, etc.**

***SEND FOR REVISED PRICE LIST.***

No. 900.

## H. W. JOHNS MFG. CO.,

**240-242 Randolph Street, CHICAGO.**

NEW YORK. PHILADELPHIA. BOSTON.

No. 905.

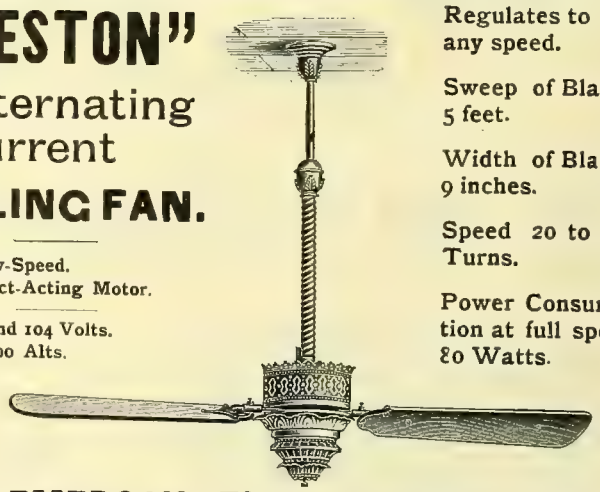
## "MESTON"

Alternating Current

**CEILING FAN.**

Slow-Speed.
Direct-Acting Motor.

52 and 104 Volts.
16,000 Alts.



Regulates to any speed.

Sweep of Blades 5 feet.

Width of Blades 9 inches.

Speed 20 to 144 Turns.

Power Consumption at full speed 80 Watts.

## THE EMERSON ELECTRIC MFG. CO.,

1108, 1110, 1112 St. Charles St., ST. LOUIS, MO.

ELECTRIC SUPPLIES.
LIGHTING PLANTS.
ENGINEERING.
CONTRACTING
TESTING.
RAILWAYS.
INCANDESCENT WIRING.
CONSULTING.

## Thayer Electric Co.,

**1027 Garfield Building,**

**CLEVELAND, O.**

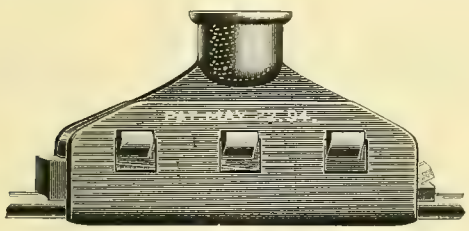
TELEPHONE 2910.

**Don't let your contracts until you get our prices.**
**Prompt attention given to all orders.**

# NEW YORK ELECTRICAL WORKS,

161 Washington St., New York.

## MECHANICAL CLIP

OUR  IS

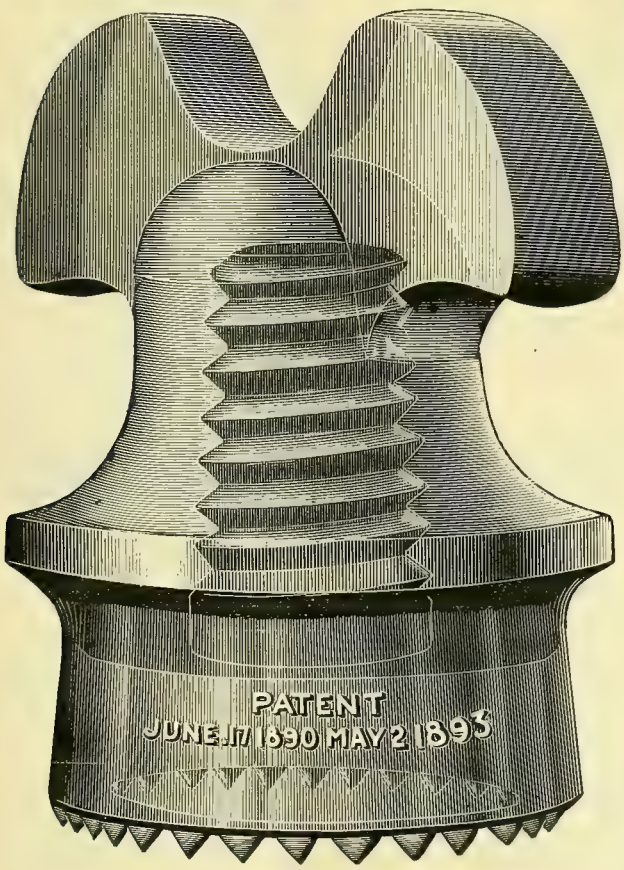
## THE BEST.

# HEMINGRAY GLASS CO.,

*ESTABLISHED 1848,*

**COVINGTON, KY.,**

Sole Licensees of the Oakman Patents for the West.




CABLE INSULATOR. FULL SIZE.

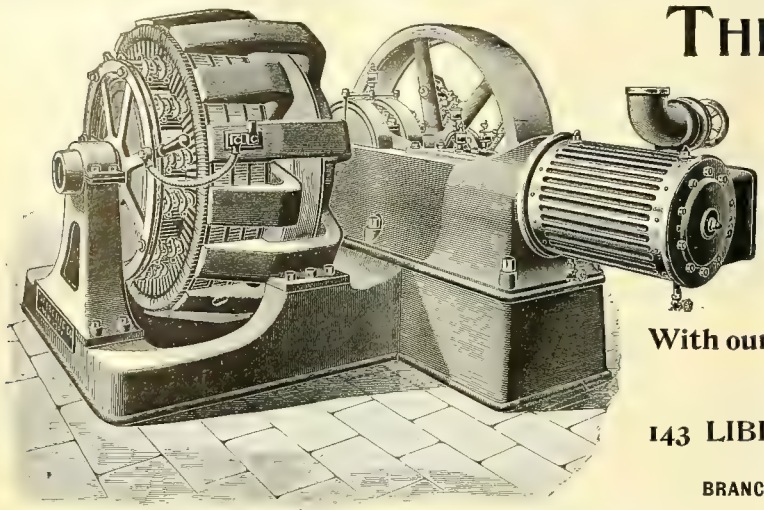
MANUFACTURERS OF

## CABLE, COLUMBIA AND JUMBO

# INSULATORS.

ALSO PONY, DEEP GROOVE AND DOUBLE PETTICOAT INSULATORS FOR ALL PURPOSES, GLASS BREAK KNOBS, BATTERY JARS, ARC LIGHT GLOBES, ETC.

All Insulators made by us have our patent drip arrangement on the petticoats.



# THE C & C ELECTRIC CO.

MANUFACTURERS OF

## Bipolar AND Multipolar Dynamos,

Automatic and Hand Controlled Motors,
Complete Plants for Power Transmission,
Isolated Lighting Plants, Central Station Apparatus.

**With our Extensive Works we are prepared to fill promptly all orders for 1 H.-P. to 250 H.-P.**

GENERAL OFFICES: 143 LIBERTY ST., NEW YORK.

WORKS: GARWOOD, N. J. On Central R. R. of N. J.

BRANCH OFFICES: CHICAGO, Monadnock Building. BOSTON, 63 Oliver Street. CLEVELAND, Cuyahoga Building. PHILADELPHIA, 633 Arch Street.

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B. B. CLARKE, Vice-Prest. H. C. DODGE, Gen'l Supt. R. M. LAMP, Treasurer.
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## THE STANDARD

# Telephone and Electric Co.,

MADISON, WIS., U. S. A.

MANUFACTURERS OF THE

## STANDARD LOUD SPEAKING TELEPHONE.

**Employing Milde Microphone.**

U. S. Patent granted April 17, 1894.

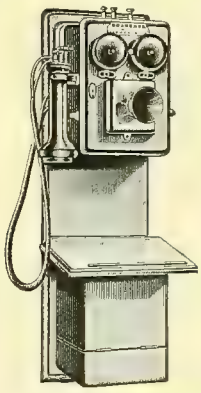
**Perfect in Detail, of Highest Efficiency, and Best Possible Electrical and Mechanical Construction.**

Sole Agents for the United States for the celebrated

### Milde Battery Transmitter.

Sensitive as a Blake.
Powerful as a Solid-back.
No adjustment required.
Will not Pack or get out of order.

**For Simplicity, small dimensions, entire multicontact, and powerful transmission it has no equal. Adopted by Governments, Exchanges and Railways in EUROPE, ASIA and SOUTH AMERICA.**



### Standard Telephones

Have been adopted by Telephone Exchanges, Leading Railway Companies and Corporations, throughout the United States, for long distance work after severe comparative tests.

### Our Warehouse Telephone System

Is in use in Public Buildings, Banks, Wholesale Houses and Factories.

### Contractors for Complete Telephone Exchanges

For Cities, Towns or Villages, Toll Lines and Warehouse Plants.

**LONG AND SHORT DISTANCE. (Non-Infringing)**

**The Milde Transmitter** has received the following awards:—Gold Medals at Havre, Barcelona, and Brussels, 1887-88; eight Gold and Bronze Medals, Paris, 1889; Gold Medal, Edinburgh, 1890; Hors Concours, Paris, 1890, Chicago, 1893, and numerous others. **COMPARISON INVITED.**

***Trial Instruments sent to any part of the United States.***
***Many leading Supply houses handle our apparatus exclusively.***
***Prices moderate. Liberal discount to dealers ordering in quantities.***

**Correspondence Solicited.**

We Sell on Merit, and will Guarantee Perfect Satisfaction.

---

# The M. & B. Telephone Co.

Own letters patent No. 361,124, issued April 12, 1887, which covers all possible forms of Battery Transmitters in which the Electrodes are *not* in *constant contact*, and they are not affected in any way by the Berliner Transmitter Patent. Send in your orders.

## THE U. S. TELEPHONE CONSTRUCTION CO.,

GENERAL AGENTS,

Bullitt Building, . . Philadelphia.

---

# TELEPHONES!!

This company is manufacturing **A Compound Magneto Telephone**

Which it sells outright under a guarantee both as to efficiency and as against infringement of patents.
It talks as well over one hundred miles as any other Telephone talks over one mile.
This company is also prepared to fully equip Telephone exchanges, (furnishing everything from the telephone to the wire and poles). Private lines, Factory plants, etc., and do all kinds of construction work. Send for circulars and price lists.

**WESTERN TELEPHONE CONSTRUCTION CO.,**
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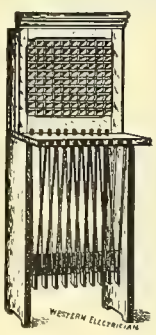

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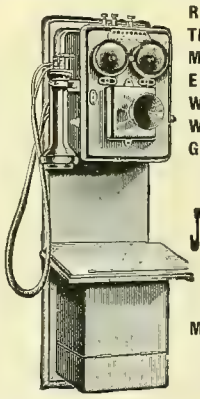

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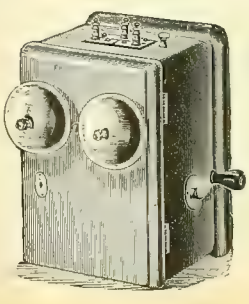

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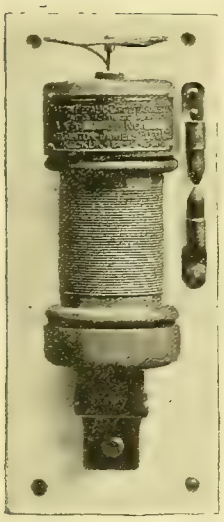

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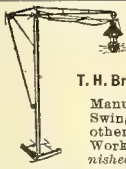

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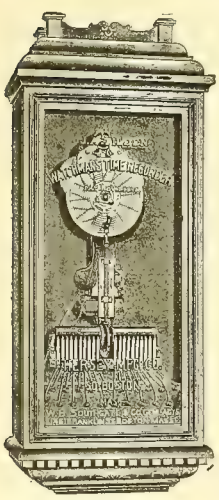

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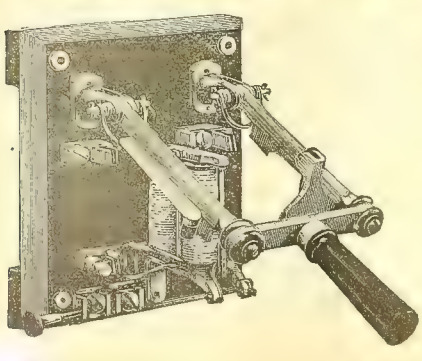

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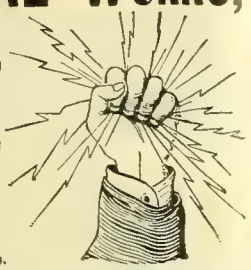

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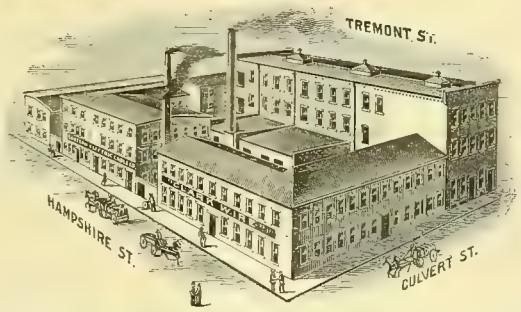


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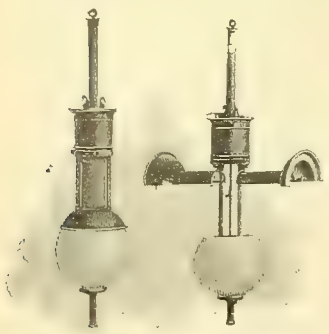

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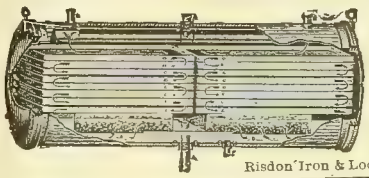

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Entirely prevents *scale* in Steam Boilers. Catalogue on application.

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Department of the Interior, Washington, D. C., June 27, 1895. Sealed proposals, in duplicate, will be received at the Department of the Interior until 2 o'clock p. m. Monday, July 22, 1895, for the furnishing and installation of an Electric Light Plant at the Government Hospital for the insane near Washington, D. C., in accordance with specifications to be had on application to the Department. A certified check for five per cent. of the amount of the bid must accompany each proposal Bond with approved sureties for the faithful performance of the contract will be required of the successful bidders. The right is reserved to reject any and all bids, to waive technical defects and to accept any part of any bid, or reject the other part if the interests of the Government require it. Proposals must be submitted in duplicate, addressed to the Secretary of the Interior, Washington, D. C., sealed and endorsed on the envelope: "Proposals for Electric Light Plant for the Government Hospital for the Insane." The proposals received will be opened at the time and place above stated and bidders are invited to be present at such opening. WM. H. SIMS, Acting Secretary.

# Table Push.

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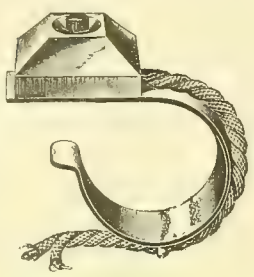

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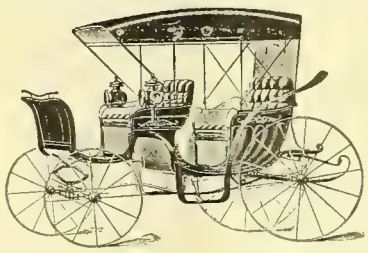

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The Imperial Dry Battery is Mr. Wm. Burnley's latest and improved Dry Battery, and superior in every respect to his first, or the old "Burnley Dry" Battery.

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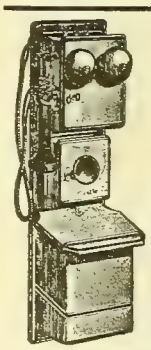

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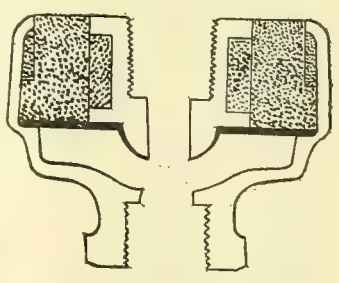

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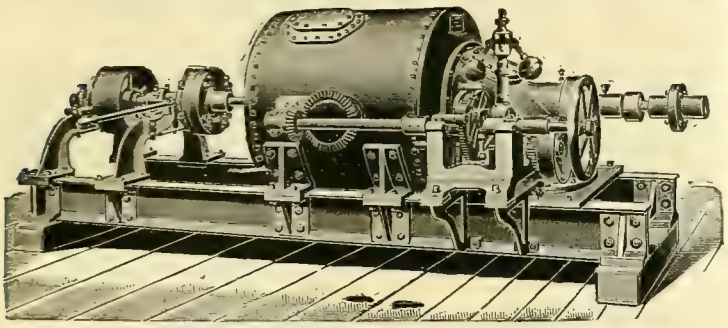

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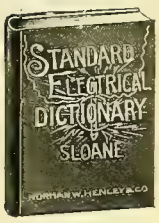


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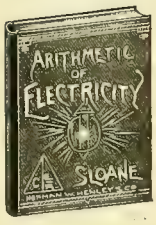


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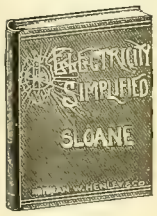


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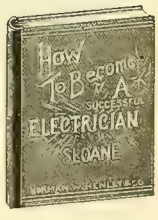


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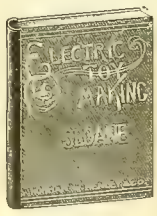


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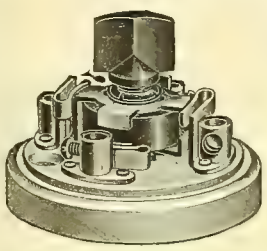

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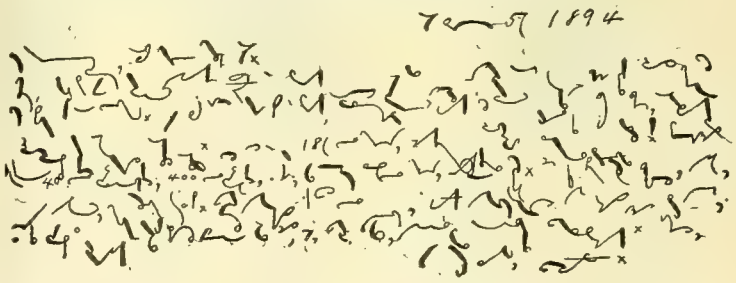

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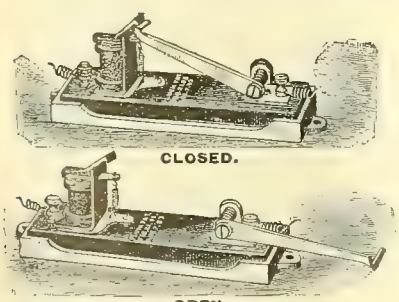

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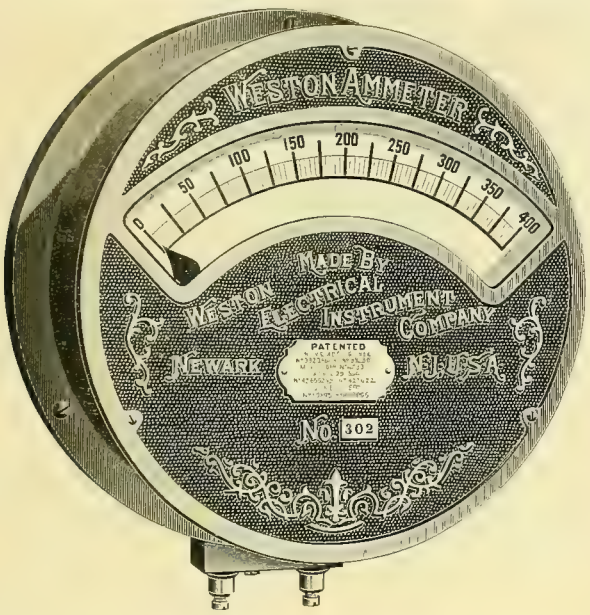


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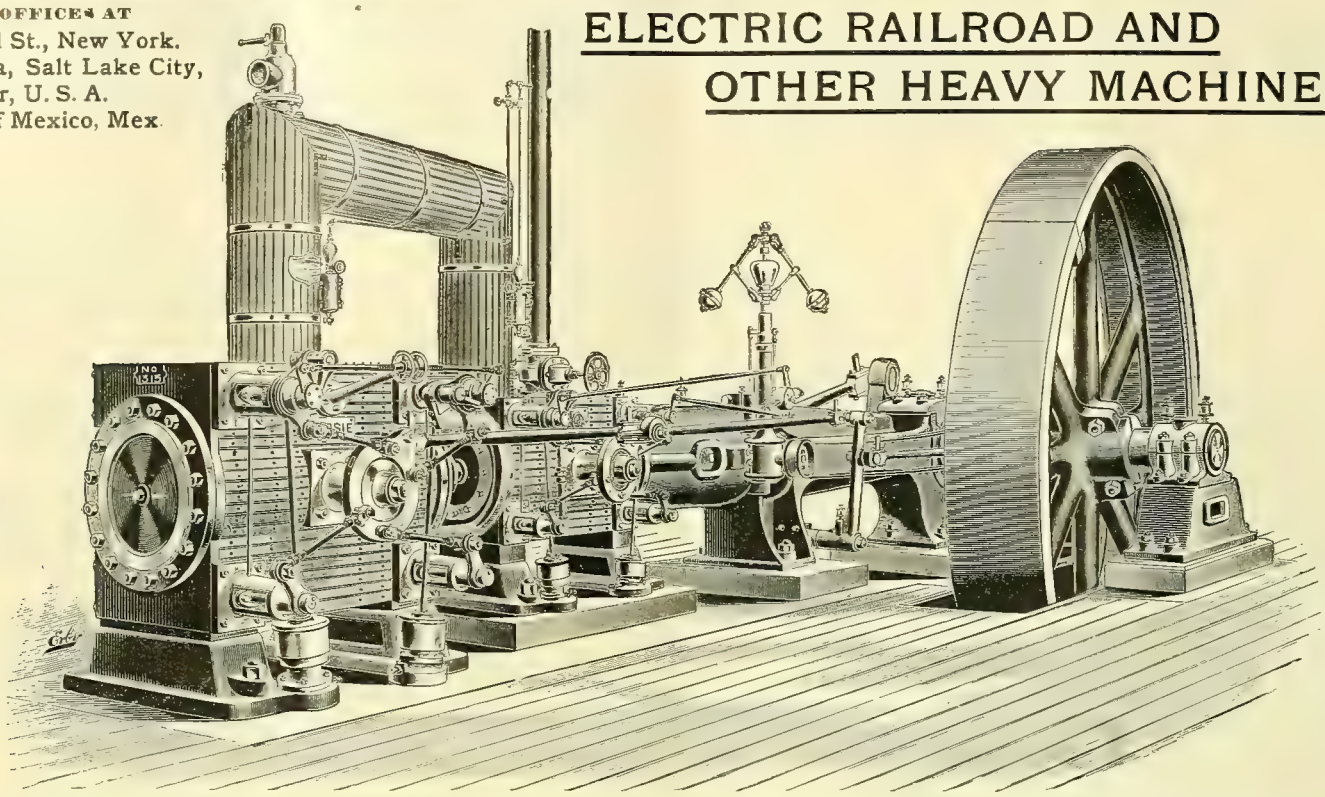

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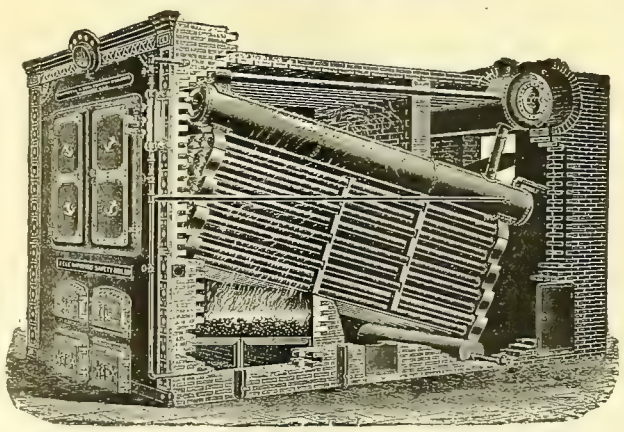

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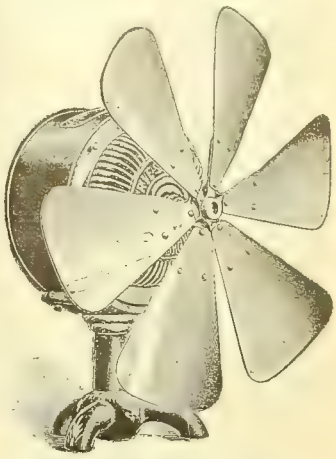

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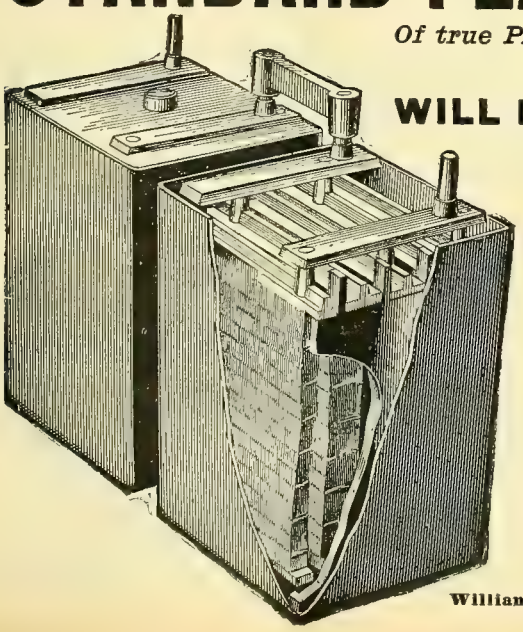

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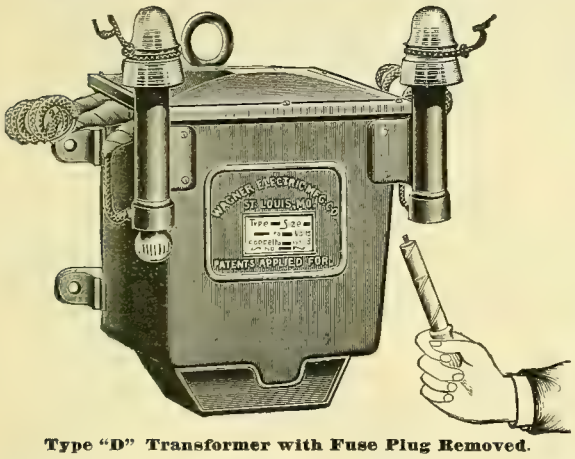


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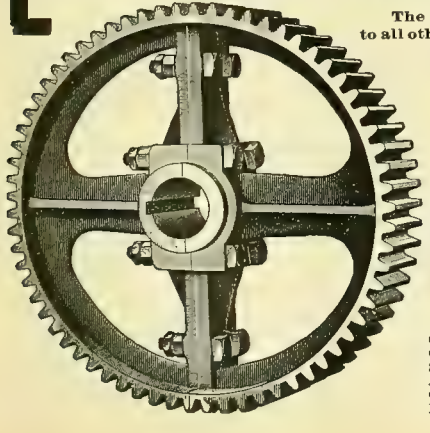

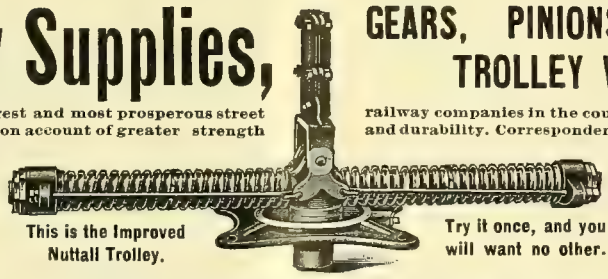

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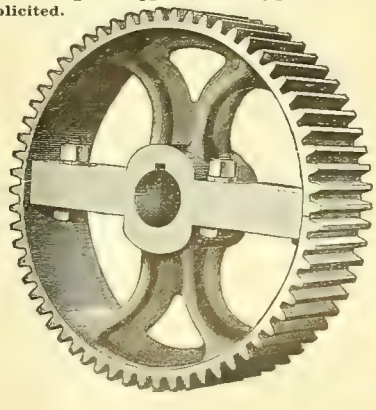

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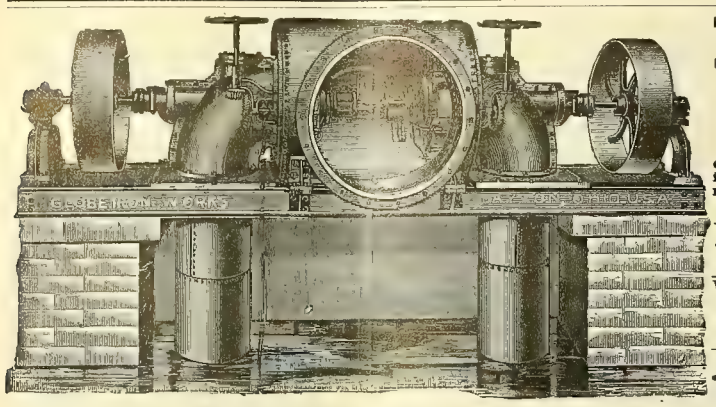

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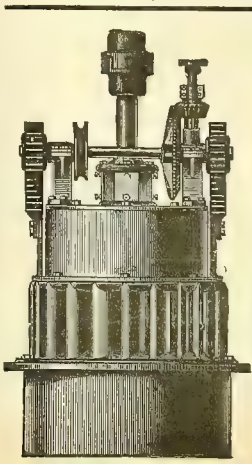

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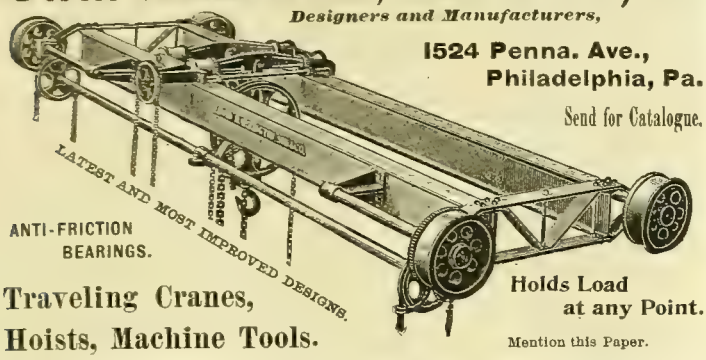


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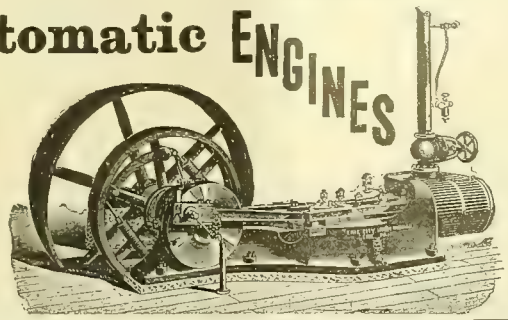

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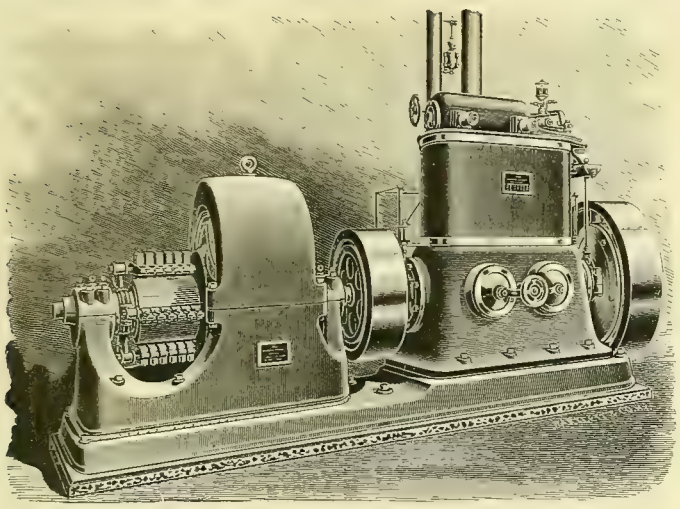

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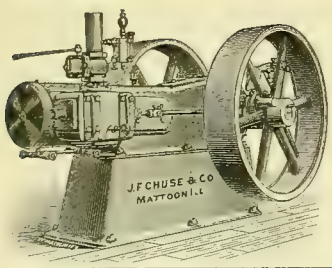


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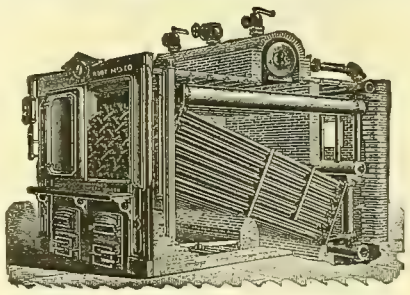

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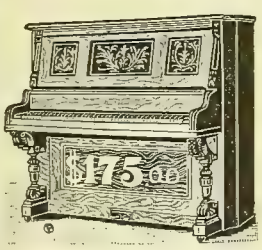

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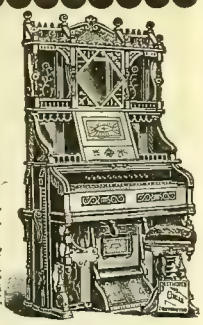

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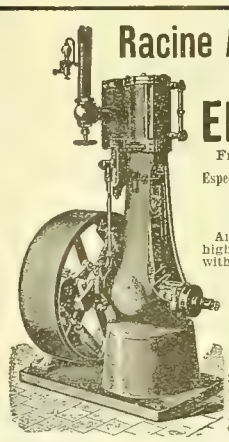

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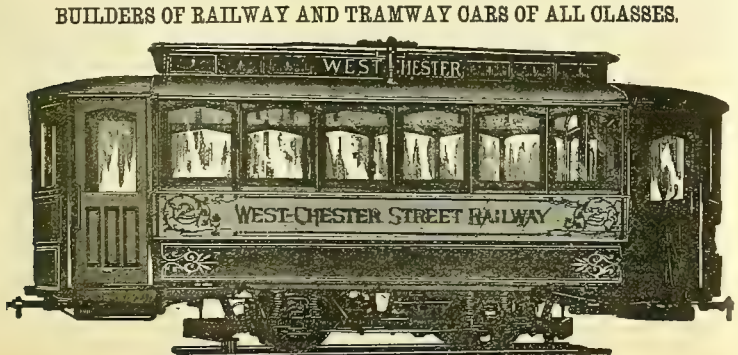


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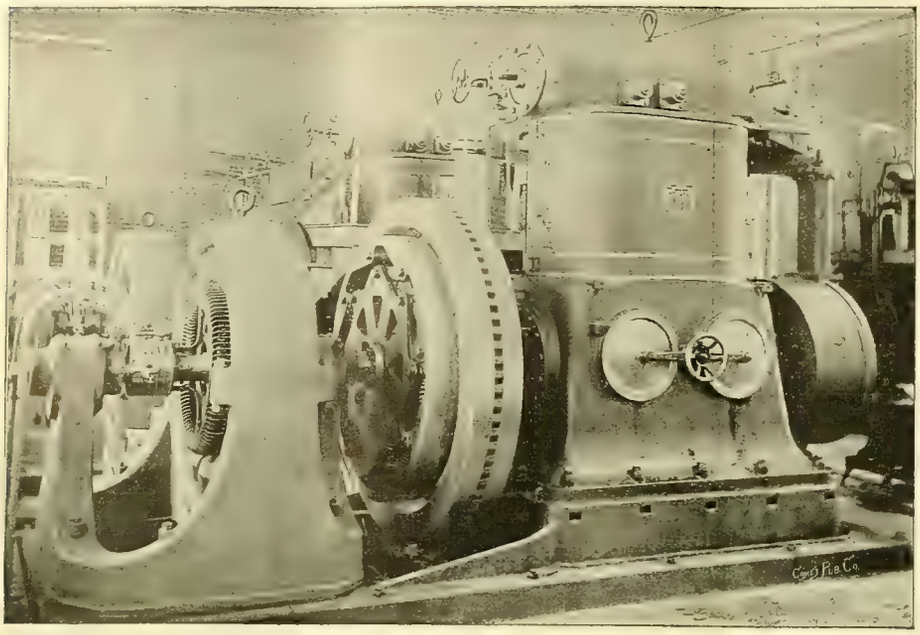

500 Horse Power Polyphase Generators in power house of the Westinghouse Electric and Manufacturing Company, at East Pittsburg, Pa.

# Westinghouse Electric and Manufacturing Company,

## Sole Owners of the

# TESLA POLYPHASE SYSTEM.

The ideal system for the distribution of power and light in factories and mills.

Motors, Arc Lights and Incandescent Lights supplied from the same circuits.

The system adopted by the Cataract Construction Company for their great plant at Niagara.

Adapted for transmission of power over long distances, also for local distribution of power.

Brushes and moving contacts may be dispensed with, rendering the system peculiary useful in mining operations.

All machinery in our new works at East Pittsburg driven by Tesla Polyphase Motors, supplied from a Central Power Plant.

RESULTS: High Efficiency, Convenience, Economy of Installation and Operation, and Flexibility.

Inspection invited.

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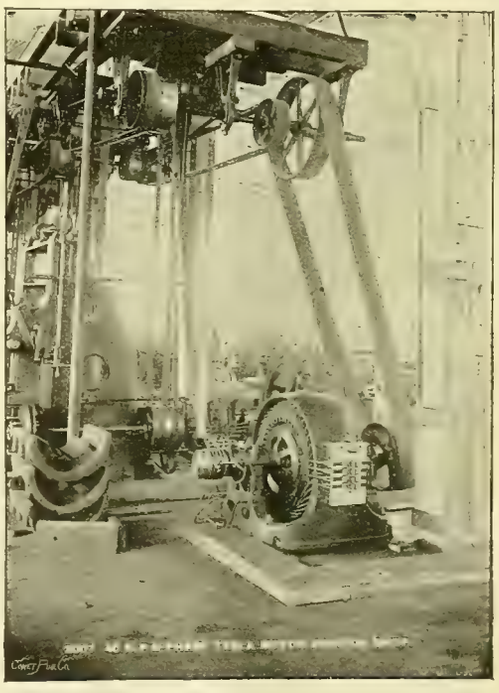
Two suits are now pending against the Thomson-Houston Company under the Tesla Patents. Upon motion of the Westinghouse Company in the Circuit Court at New Haven recently, the Thomson-Houston Co. were limited to October 7th to take their testimony in defense. The suits will therefore be ready for argument in the near future.

The novelty of Mr. Tesla's invention was recognized by ***PROF. ELIHU THOMSON,*** who said in discussing the Tesla inventions before the American Institute of Electrical Engineers in 1888:

"I have certainly been very much interested in the description given by Mr. Tesla of his ***new and admirable*** little motor. I have, as probably you may be aware, worked in somewhat similar directions and towards the attainment of similar ends. The trials which I have made have been by the use of a ***single*** alternating current circuit, not a ***double*** alternating circuit."



Forty Horse Power Tesla Polyphase Motor operating machinery in shops at East Pittsburg.

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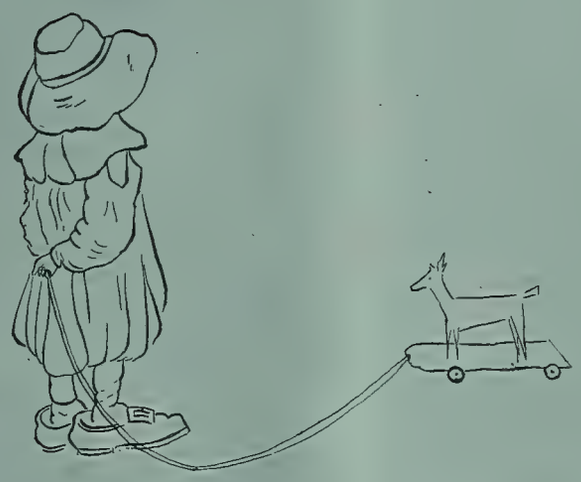

Experts and operators of **"Wood" Electric Lighting and Power Apparatus** write in the opinion that it is **unequaled** in design and construction by any other Lighting Apparatus offered for sale. The large number of plants operating **"Wood" Apparatus** exclusively attest its popularity.

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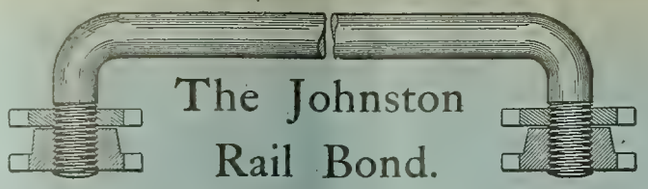

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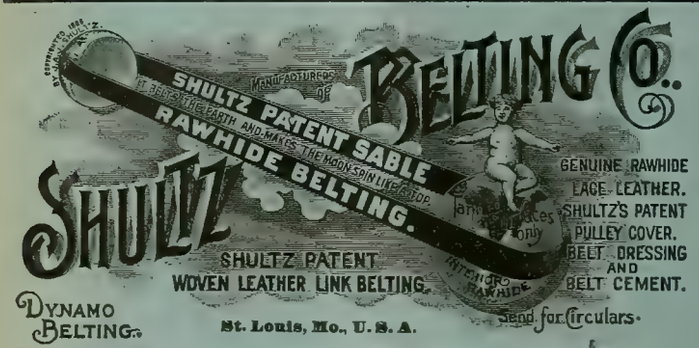


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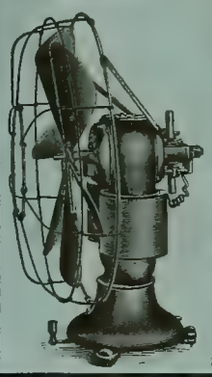

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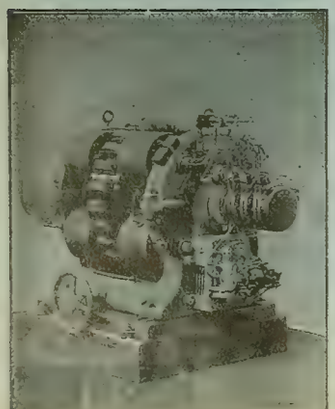

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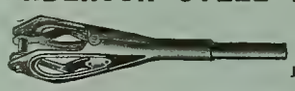

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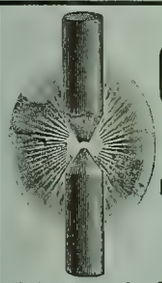

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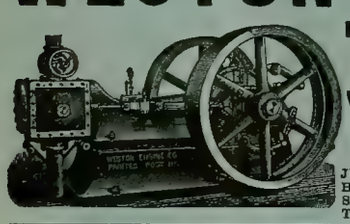

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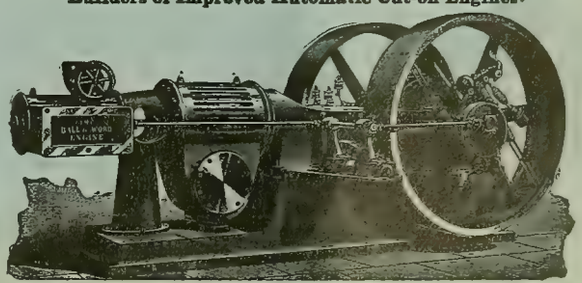

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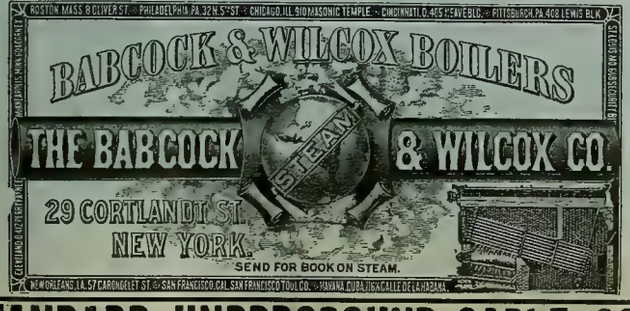


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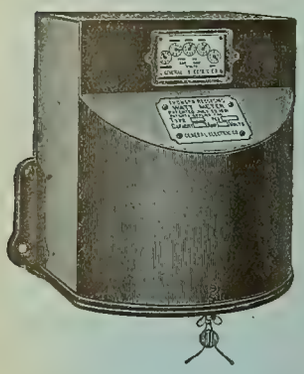

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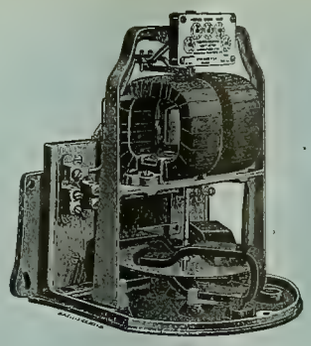

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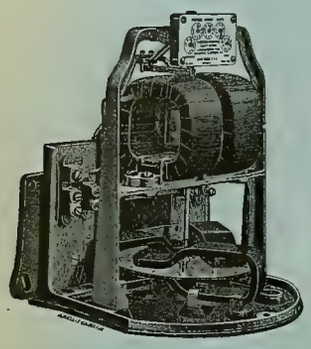

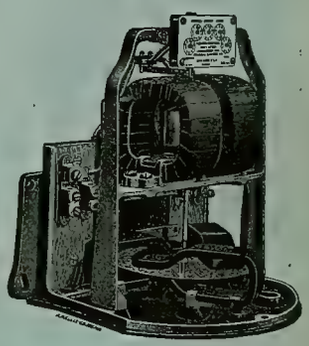

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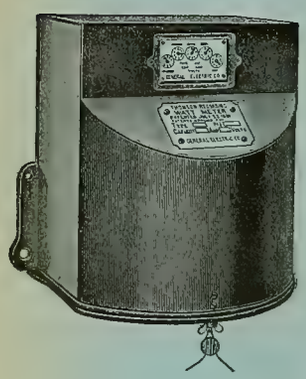

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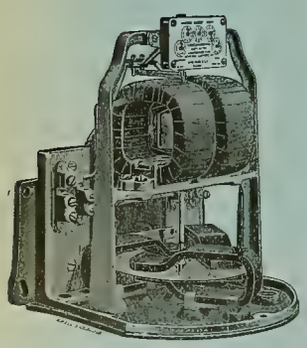

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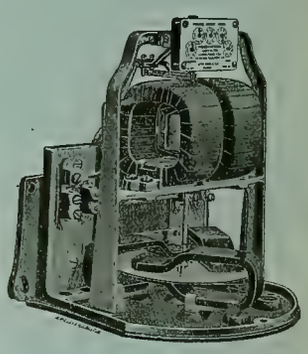

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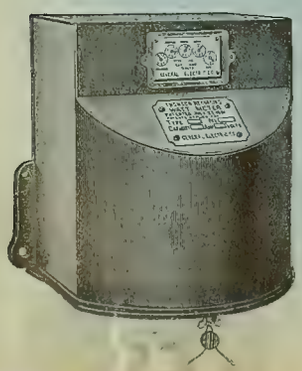

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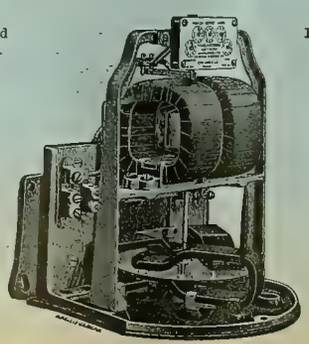

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**Accumulators.**
Boswell & Co., D. E.,
Bradbury-Stone Elec. S. Co
Electric-Power Storage Co.
Electric Storage Battery Co.
Porter & Buerdorf.

**Annunciators.**
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Electric Appliance Co,
Ostrander & Co., W. R,
Partrick & Carter Co.

**Arc Lamps.**
Central Electric Co.
Corey, R. B.
Crocker-Wheeler Elec. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Helios Electric Co.
Little, F. P. Elec. C. & S. Co.
Perkins El. Switch Mfg. Co.
Standard Electric Co.
Standard Thermometer Co.
Westinghouse El. & Mfg. Co.

**Arc Light Cord.**
Samson Cordage Wks.

**Batteries and Jars.**
Andrae & Sons, J.
Boswell & Co., D. E.
Boynton Multivolt Batt'y Co.
Bradbury-Stone Elec. S. Co.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Central Electric Co.
Edgerton Pottery Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Hemingray Glass Co.
Leclanche Battery Co., The.
Miamisburg Electric Co
Newton Rubber Wks.
Partrick & Carter Co.
Western Electric Co.

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Central Electric Co.
Electric Appliance Co.
Gillette, E. & F.
Huebel & Manger
Ostrander & Co., W. R.
Partrick & Carter Co
Western Electric Co.

**Belting.**
Shultz Belting Co.

**Boilers.**
Abendroth & Root Mfg. Co.
Babcock & Wilcox Co., The.
Clonbrock Steam Boiler Co.
Erie City Iron Wks.
Fulton Steam Boiler Wks.
Moyes, L. M.
Racine Hardware Co.
Weston Engine Co.

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Electrician Publishing Co.

**Bronze.**
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co., Ltd.

**Brushes.**
Belknap Motor Co.
Boudreaux Dyn. Brush Co.
Central Electric Co.
Partridge Carbon Co.

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Central Electric Co.
Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

**Cables** (See Insulated Wires.)

**Cables, Electric** (See Insulated Wires), **Copper, Sheet and Bar.**
American Elec. Works.
Brixey, W. R.
Central Electric Co.
Chicago Ins. Wire Co.
Eastern Electric Cable Co.
Elec. Engr. & Supply Co.
Moore, Alfred F.
New York Ins. Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co
Western Electric Co.

**Carbons, Points & Plates.**
Central Electric Co.
Corey, R. B.
DeRonde & Co., A.
General Electric Co.
Hardmuth & Co., F.
Partridge Carbon Co.
Reisinger, Hugo.
Wertheim, Ed.
Western Electric Co.

**Carriages and Buggies.**
Henney Buggy Co.

**Clocks, Watchmen's.**
Southgate & Co., W. B.

**Compound.**
Standard Paint Co.
Tornberg, Edw. R.

**Conduits.**
Central Electric Co.
Interior Conduit & Ins. Co.
National Conduit Mfg. Co.

**Construction & Repairs.**
Crocker-Wheeler Elec. Co.
Ft. Wayne Elec. Corporation.
Interstate Com. El. Const. Co.

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Arnold, B. J.
Bain, Foree.
Brush Electric Co.
Bryan, Wm. H.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Fontaine Crossing & El. Co.
Ft Wayne Elec. Corporation.
General Electric Co.
Goltz & Sinclair.
Interior Conduit & Ins. Co.
Siemens & Halske Elec. Co.
Standard Electric Co.
United Elec Improvement Co
Walkins, Louis E.
Westinghouse Elec & Mfg. Co.
Western Electric Co.
Woods & Co., C. E.

**Copper.**
Besly & Co., Chas. H.
Miamisburg Electric Co.

**Copper Wire Bought.**
Swarts Metal Refining Co.

**Copper Wires.**
American Electrical Works.
Besly & Co., Chas. H.
Brixey, W. R.
Bunnell & Co., J. H.
Central Electric Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.
National India Rubber Co.
Okonite Co. The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Western Electric Co.

**Cordage.**
Samson Cordage Wks.

**Cranes.**
Harrington, Son & Co , E.

**Cross-Arms, Pins and Brackets.**
Anderson, Albert & J. M.
Brady, T. H
Brodie Electric Co.
Central Electric Co.
Electric Appliance Co.
Elec Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Nuttal Co., R. D.
Partrick & Carter Co.

**Cut-Outs and Switches.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Brodie Electric Co.
Bryant Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Edison Co.
Colgate Co., Geo. L.
Crocker-Wheeler Elec. Co.
Cutter Electrical & Mfg. Co.
Diamond Electric Co.
Eddy Elec. Mfg. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric Protection Co.
Elec. Selec. & Signal Co.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Forest City Elec. Wks.
Forsyth & Fisk.
Ft. Wayne Elec. Corporation.
General Electric Co.
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Huebel & Manger.
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Nuttall Co., R. D.
Partrick & Carter Co.
Perkins El. Switch Mfg. Co.
Platt, O. S.
Wagner Elec. Mfg. Co.

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Central Electric Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Elliott-Lincoln Elec. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
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Interior Conduit & Ins. Co.
Roth Bros. & Co.
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Siemens & Halske Elec. Co.
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Walker Mfg. Co.
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Bryan, Wm. H
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Ford, Owen.
Goltz & Sinclair
Thayer Electric Co.
Watkins, Louis E.
Woods & Co., C. E.

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Bunnell & Co., J. H.
Central Electric Co
Diamond Electric Co.
Electric Appliance Co
Elec. Engr. & Supply Co.
Interior Conduit & Ins. Co.
Nuttall Co., R. D.
Partrick & Carter Co.
Platt, O. S
Queen & Co. Inc.

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Interstate Com. El. Const Co.
S. K. C. Specialty Co.

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Chuse & Co., J. F.
Erie City Iron Wks.
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Brixey, W. R.
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Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.

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Partrick & Carter Co.

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Besly & Co., Chas. H.
Nuttall Co., R. D.

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Bryant Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Edison Co.
Colgate Co., Geo. L.
Cutter Electrical & Mfg. Co.
Dieterichs-Warwick El. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric Protection Co.
Elliott-Lincoln Elec. Co.
Farr Tel. & Const. Supply Co.
Forest City Elec. Wks.
Garton-Daniels Elec. Co.
General Electric Co
Goltz & Sinclair.
Hayes, Fyfe Co.
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Metropolitan Electric Co.
Morris & MacCurdy.
Partrick & Carter Co.
Perkins El. Switch Mfg. Co.
Platt, O. S.
Queen & Co Inc.
Sioux City Brass Works.
S. K. C. Specialty Co.
Standard Tel. & Elec. Co.
Thayer Electric Co.

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Edwards, W. S. Mfg. Co.
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Dixon Crucible Co., Jos.

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Fiberite Co., The.
Newton Rubber Wks.

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Anderson, Albert & J. M.
Andrae & Sons, J.
Brixey, W. R.
Brodie Electric Co.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Central Electric Co.
Chicago Ins. Wire Co.
Crocker-Wheeler Elec. Co.
Cutter Elec. & Mfg. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Empire China Works.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Hart & Hegeman Mfg. Co.
Hemingray Glass Co.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Little, F. P. Elec. C. & S. Co.
Munsell & Co., Eugene.
National India Rubber Co.
Newton Rubber Wks.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Platt, O. S.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Paint Co.
Standard Underground C. Co.

**Insulated Wires and Cables—Magnet Wire.**
American Electrical Works.
Brixey, W. R.
Brodie Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Ins. Wire Co.
Eastern Electric Cable Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
General Electric Co.
Independent Electric Co.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.

**Lamps, Incandescent.**
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Buckeye Electric Co.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Globe Electric Light Co.
New York & Ohio Co.
Partrick & Carter Co.
United Elec. Imp. Co.
Westinghouse Elec. & Mfg Co.

**Lightning Arresters.**
Colgate Co., Geo. L.
Diamond Electric Co.
Electric Appliance Co.
General Electric Co.
Garton-Daniels Elec. Co.

**Magnet Wire.**
(See Insulated Wires.)

**Mechanical Machinery**
Besly & Co., Chas. H.
Harrington, Son & Co., E.
Lukens Iron & Steel Co.

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Johns Mfg. Co., H. W.
Munsell & Co. Eugene.

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Independent Electric Co.
Westinghouse El. & Mfg. Co.

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Belknap Motor Co.
Brush Electric Co.
Central Electric Co.
Crocker-Wheeler Elec. Co.
Dieterichs-Warwick El. Co.
Eddy Elec. Mfg. Co.
Elec. Engr. & Supply Co
Elliott-Lincoln Elec. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Roth Bros. & Co.
Royal Electric Co.
Sioux City Brass Works
Standard Electric Co.
Stanley Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
Walker Mfg. Co.
Westinghouse El. & Mfg. Co.

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Garlock Packing Co.

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Standard Paint Co.

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Electric Appliance Co.
Ostrander & Co., W. R
Partrick & Carter Co

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Colgate Co., Geo. L.
Diamond Electric Co.
Queen & Co. Inc.

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Goubert Mfg. Co.
Webster & Co., Warren.

**Storage Batteries.**
Boswell & Co., D. E.
Bradbury-Stone Elec. S. Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Porter & Buerdorf.

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Brill, J. G. Co.

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Central Electric Co.
Chicago Ins. Wire Co.
Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Paint Co.

**Telegraph Apparatus.**
Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

**Telephones and Telephone Material.**
Andrae & Sons, J.
Central Electric Co.
Farr Tel. & Const. Supply Co.
Forsyth & Fisk.
Gillette, E. & F.
Gustafson, W. A.
Mo. Telephone Mfg. Co
Partrick & Carter Co.
Phila. Telephone Co.
Public Telephone Co.
Standard Tel. & Elec. Co.
U. S Tel. Const. Co.
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Western Electric Co.
Western Tel. Const. Co.

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General Electric Co.
Bornberger Elec. Mfg. Co.
Royal Electric Co.
Stanley Electric Mfg. Co.
Wagner Elec. Mfg. Co.

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Samson Cordage Wks.

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Smith, S. Morgan.
Stillwell-Bierce & Smith-Vaile Co.

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Int. Corr. Schools.
Rose Poly. Institute.

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Leffel & Co., Jas
Smith, S. Morgan.

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Anderson, Albert & J. M.
Besly & Co., Chas. H.
Bishop Gutta Percha Co.
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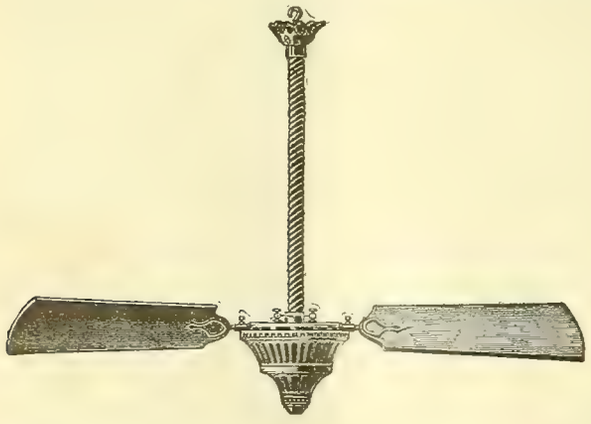

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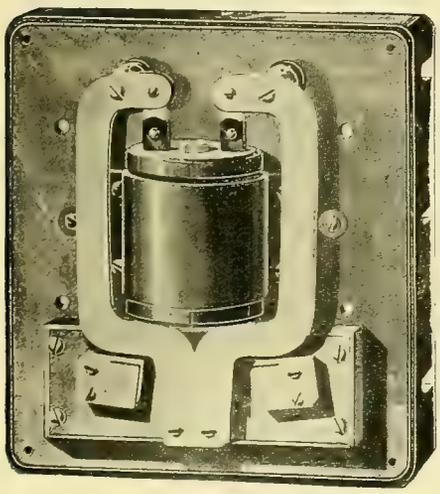

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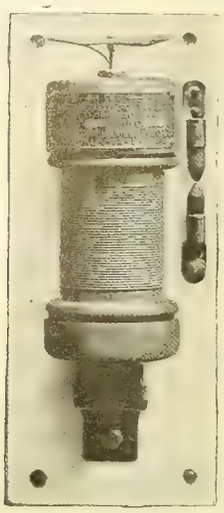

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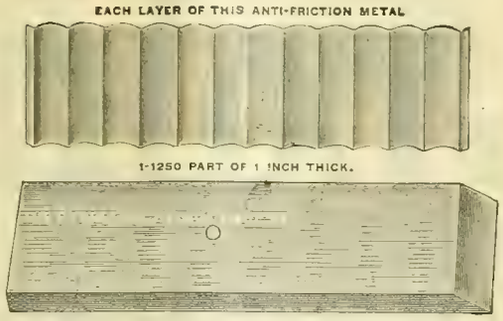
## USE THE BOUDREAUX DYNAMO BRUSH.

The Boudreaux Dynamo Brush Co. NO GAUZE.

The Boudreaux Dynamo Brush Co. NO CARBON.

NO SPARKING. NO CUTTING.

NO TRIMMING. NO GREASING.




The Boudreaux Dynamo Brush Co. NO WOVEN WIRE.

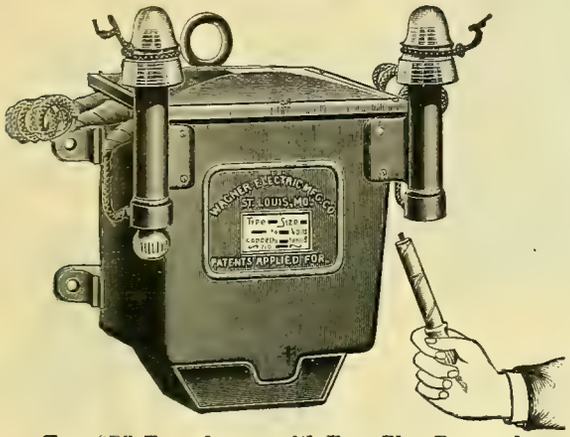
The Boudreaux Dynamo Brush Co. NO COPPER.

**THE BOUDREAUX DYNAMO BRUSH CO.,**

Mallers Building, CHICAGO. Postal Te'egraph Building, NEW YORK.

Sole Agent for Canada, E. E. T. PRINGLE, Montreal, Que. Sole Agent for New England States, ALTON D. ADAMS, Boston.
Sole Agents for the Pacific Coast, J. W. BROOKS & CO., 120 Sutter St., San Francisco, Cal.

# TRANSFORMERS.




Type "D" Transformer with Fuse Plug Removed.

***A New Type*—*Transformer, Primary Cut-outs and Insulator Brackets all combined.***

**No more brackets pulling off of walls.**

**With our wall or cross-arm hooks, transformer may be *Hung* and *Connected* in *Five minutes*.**

**Our new fuse plugs will not hold an arc with 5,000 volts.**

***Our Transformers* are acknowledged by all experts to be the *Highest* in *Efficiency* ever made.**

**Adopted by the largest stations in the country.**

***We Challenge Competition* in any form of test, in laboratory or practical use.**

**Made in all sizes, 5 lights to 3,000 lights.**

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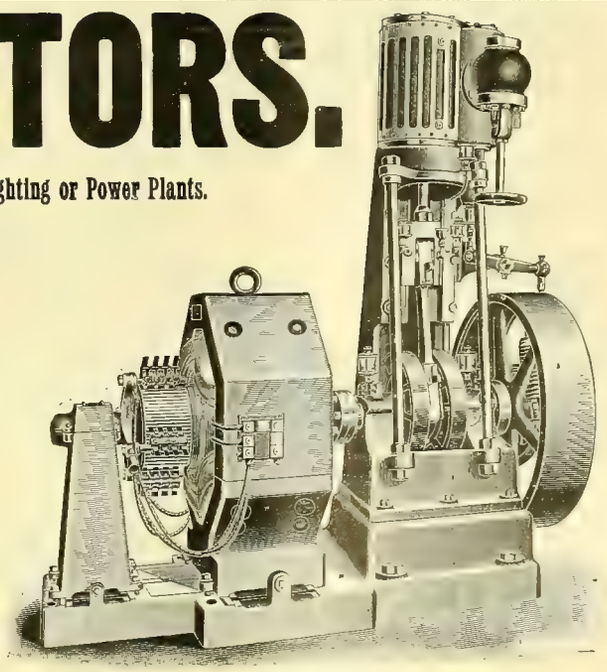
*We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.*



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*WINDSOR, CONN.*

**NEW YORK OFFICE, HAVEMEYER BLDG.**

*REPRESENTED BY:*

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# INCANDESCENT LAMPS.

WE MANUFACTURE THE "GLOBE." LIFE AND EFFICIENCY GUARANTEED.

New Process of Exhaustion by Mechanical Vacuum Pump. Absolutely Dry Vacuum. Samples and Prices Furnished on Application. Correspondence Solicited.

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*We have no Stock nor Old Style Lamps that we must get rid of at any price—no junk.*

### THE HELIOS LAMPS

Are the latest patterns and newest type. Our Lamps are much in advance of any lamp now on the market, because they are New and of Latest Designs.

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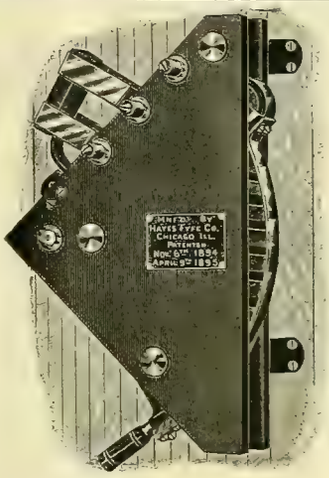
W. T. M. Mottram, Agent for Texas, Dallas, Tex.
Canadian General Electric Co., Canadian Agents, Toronto, Canada.
California Electrical Works, San Francisco, Cal.

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Guaranteed Fireproof.
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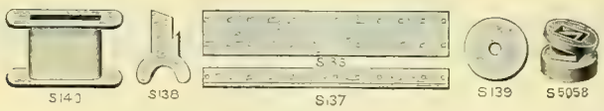


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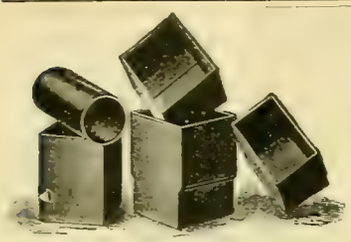

# THE FREEMAN

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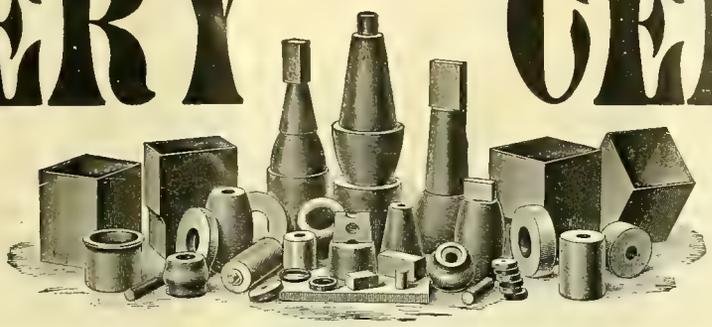
Estimates Furnished on Application. Prompt Delivery.



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The composition used in the manufacture of these battery cells makes them positively acid-proof, which result has never before been accomplihsed providing additional strength to such an extent that this cell can be used where no other would be practical.

## THESE CELLS ARE A NEW PRODUCTION AND FULLY GUARANTEED.

**AGENTS WANTED IN ALL CITIES.** **WRITE US FOR INFORMATION AND CATALOGUE.**

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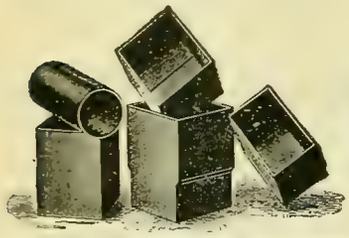

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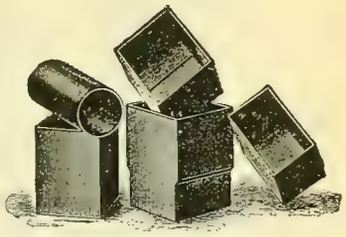

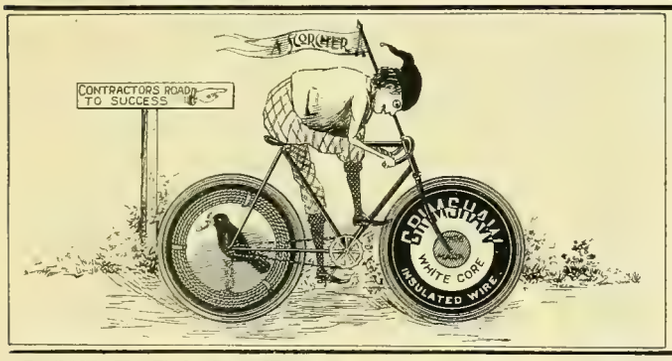


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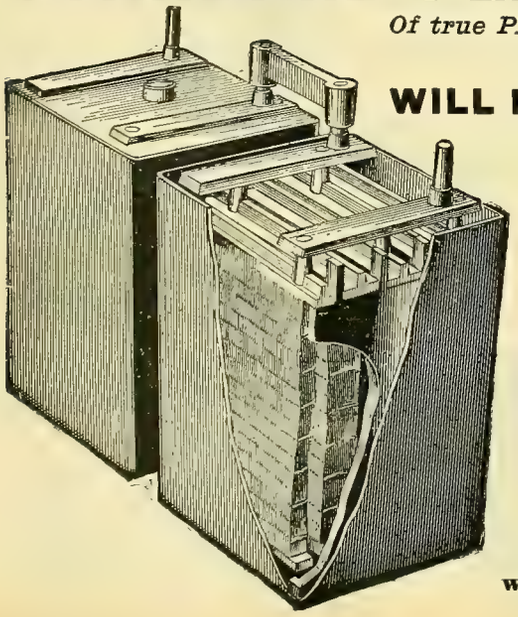
# STANDARD PLANTE STORAGE BATTERIES

*Of true PLANTE Type and CRYSTALLINE FORMATION.*

Will give or receive without injury, currents that would destroy other batteries.



**WILL NOT SULPHATE, DISINTEGRATE OR BUCKLE.**

Contain no asbestos or other separating material to increase their internal resistance.

**ESPECIALLY ADAPTED TO CENTRAL STATION AND POWER-HOUSE SERVICE.**

Absolutely free circulation of electrolyte preventing discharge of one plate into another.

**Highest efficiency, largest delivery, lowest internal resistance.**

For efficiency, reliability, durability, and capacity to receive and yield excessive currents, they are unequaled by any other battery on the market in this country.

**Cannot be damaged by excessive charge or discharge currents.**

A 400 ampere current has been taken from a 120 ampere hour cell.

☞ **CHALLENGE:** We will place an equal number of these cells in series-circuit with any other cells of like capacity, and submit them to charge and discharge currents as high as the circuit can give and receive; and we guarantee no distortion or deterioration of plate in our cells under currents that no other cell will withstand.

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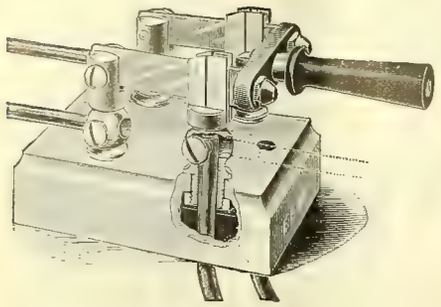
# E. E. & S. BABY.



Our Baby was born February 5th, 1895, and is thriving nicely on from ten to twenty-five amperes a day.

This Baby can be used on any circuit up to 220 volts. Can be wired for cleat, moulding or concealed work, having our special combination binding post. Is mounted on porcelain base. Dimensions 2½ in. by 1⅞ in., and stands 1¾ in. high over all. Brass and copper parts highly polished and lacquered.

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**Our Baby is easily wired.**
**Our Baby is original.**
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**Our Baby is just what you want.**
**Try some.**

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Own letters patent No. 361,124, issued April 12, 1887, which covers all possible forms of Battery Transmitters in which the Electrodes are *not* in *constant contact*, and they are not affected in any way by the Berliner Transmitter Patent. Send in your orders.

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MANUFACTURERS OF THE

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**Employing Milde Microphone.**

U. S. Patent granted April 17, 1894.

Perfect in Detail, of Highest Efficiency, and Best Possible Electrical and Mechanical Construction.

Sole Agents for the United States for the celebrated

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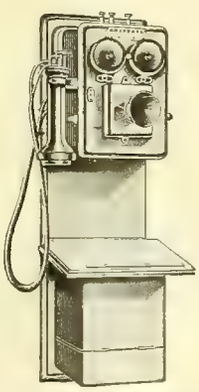
Sensitive as a Blake.
Powerful as a Solid back.
No adjustment required.
Will not Pack or get out of order.



**For Simplicity, small dimensions, entire multicontact, and powerful transmission it has no equal. Adopted by Governments, Exchanges and Railways in EUROPE, ASIA and SOUTH AMERICA.**

**Standard Telephones**
Have been adopted by Telephone Exchanges, Leading Railway Companies and Corporations, throughout the United States, for long distance work after severe comparative tests.

**Our Warehouse Telephone System**
Is in use in Public Buildings, Banks, Wholesale Houses and Factories.

**Contractors for Complete Telephone Exchanges**
For Cities, Towns or Villages, Toll Lines and Warehouse Plants.

LONG AND SHORT DISTANCE. (Non-Infringing.)

**The Milde Transmitter** has received the following awards:—Gold Medals at Havre, Barcelona, and Brussels, 1887-88; eight Gold and Bronze Medals, Paris, 1889; Gold Medal, Edinburgh, 1890; Hors Concours, Paris, 1890, Chicago, 1893, and numerous others. **COMPARISON INVITED.**

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We Sell on Merit, and will Guarantee Perfect Satisfaction.

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Which it sells outright under a guarantee both as to efficiency and as against infringement of patents.
It talks as well over one hundred miles as any other Telephone talks over one mile.
This company is also prepared to fully equip Telephone exchanges, (furnishing everything from the telephone to the wire and poles). Private lines, Factory plants, etc., and do all kinds of construction work. Send for circulars and price lists.

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With Long Distance Blake Transmitters and Standard Magnetos.
**Complete $11 00 cash per Set.**
Guaranteed positively not infringing.
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Western Agents for DANBURY ELECTRICAL WORKS.

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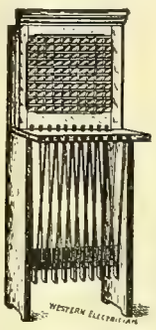

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**WITH NOVEL FEATURES.**

Furnished to Construction Companies or Consumers.

Write for prices.

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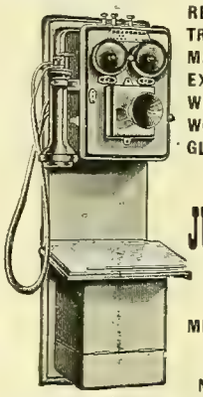

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## JULIUS ANDRAE & SONS CO.,

MILWAUKEE, - WIS.

Our Instruments are absolutely NON-INFRINGING.

**Special Agent for Okonite Wire.**

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FOR ALL PURPOSES, AT THE LOWEST PRICES.
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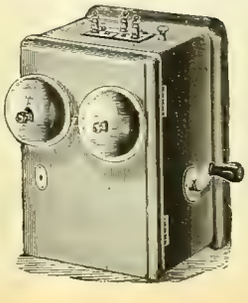

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AND

Standard Goods. No Infringements. **TELEPHONES.** Get Our Prices Before Purchasing Elsewhere.

## E. & F. GILLETTE,

**BAYPORT, CONN.**

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AT THE WORLD'S COLUMBIAN EXPOSITION.

It will be readily seen that the fan motors are the celebrated

## MESTON ALTERNATING CURRENT FAN MOTORS

Which have always been so favorably received. We are General Western Agents for the entire output of these goods, and are prepared to quote manufacturers' prices for immediate shipment from Chicago stock.

ELECTRIC APPLIANCE COMPANY EXHIBIT—WORLD'S FAIR.

**Our line of high grade Electrical Supplies is more complete than ever before, and our PRICES ARE LOWER.**

**We have added several new and desirable specialties and are in better shape than ever to handle your business--**
**SEND IT ALONG.**

GENERAL WESTERN AGENTS

# Electric Appliance Co.,

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General Western Agents PARANITE WIRES AND CABLES, "O. K." WEATHERPROOF WIRES AND CABLES. And Representing NEW YORK & OHIO CO., Warren, Ohio, Manufacturers of the Packard Lamp; PACKARD ELECTRIC CO., Warren, Ohio, Manufacturers of the Packard Transformer.

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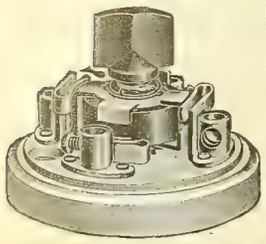
STANDARD SWITCHES, 5 and 10 ampere S. P.
10 amp. 3 and 4-way, 10, 15, 30 and 50 amp. D. P.



## FLUSH SWITCHES

Of any of the above sizes, either on single plates or with any number of switches upon one plate.

*Cut illustrates 4-way or commutation switch, controls a light or group of lights from any desired number of points.*

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Manufacturer of Mast Arms, Pole and Swinging Hoods, House Brackets and other Specialties for Construction Work. — *Catalogues and Prices furnished on application.*

## Boswell Storage Battery.

For Traction Work, Electric Lighting, Electric Launch, Telegraph, Phonograph, Surgical, and for all purposes where Light and Power are required.

**Prices on Application.**

**D. E. BOSWELL & CO.,**
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## That Mutual Confidence

existing between our customers and ourselves is the strongest indorsement we can offer intending purchases of our apparatus. Once a customer, always a customer. No electric lighting system so satisfactory: none so efficient electrically. Moderate in price.

Send for our book; tells the whole story. Only cost you a postal or a letter.

STANDARD ELECTRIC COMPANY,
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SEND FOR SAMPLES AND PRICES OF

## SAMSON SPOT CORD

For Arc Light and Trolley Cord.

**SAMSON CORDAGE WORKS, - BOSTON, MASS.**

# Public Telephone Co.,

This system does not infringe the patents of the Bell Telephone or Western Electric Co. We build exchanges complete for local companies, or will install and operate exchanges ourselves at a low monthly rental. We keep in stock Blake transmitters and all kinds of supplies.

**MANUFACTURERS OF THE SHAVER LONG DISTANCE PULVERIZED CARBON**

**Correspondence Solicited.**

**PUBLIC TELEPHONE CO.,**

**Office and Factory:**
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**For Exchanges, Etc.**

## P. & B. Armature and Field Coil Varnish.

## P. & B. Insulating Compound.

## P. & B. Insulating Tape.

**We are the sole manufacturers of the P. & B. products which have been the STANDARD for ten years.**

**Send for samples and price lists.**

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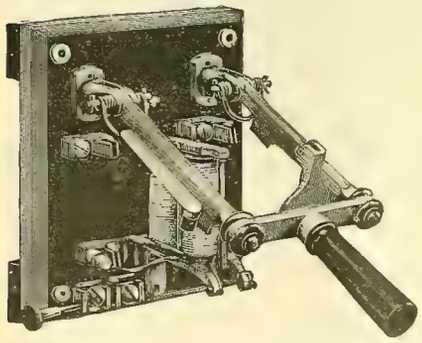
**No. 2 Liberty Street, NEW YORK.**
**LONDON:** Robert W. Blackwell, 39 Victoria St., S. W.

# MOTOR ARMATURES COST MONEY



You can prevent them from burning out by using

## THE BRODIE AUTOMATIC MOTOR-SWITCH.

It combines in one piece of apparatus a double-pole switch, adjustable limit-switch and automatic cut-out, and instantly disconnects the motor whenever it is overloaded and whenever the circuit fails from any cause.

Agents wanted in all sections of the country.

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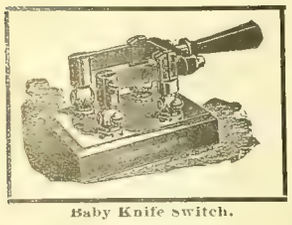

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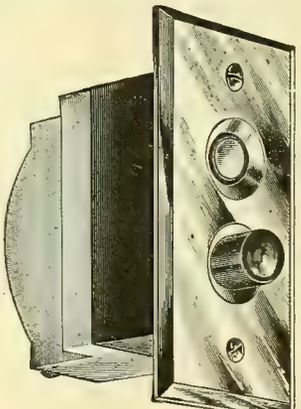

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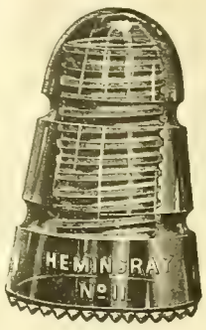


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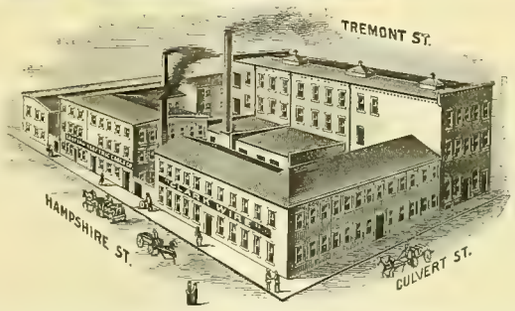


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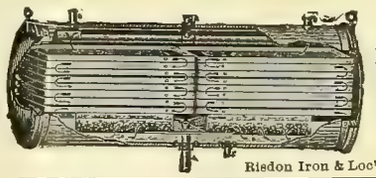

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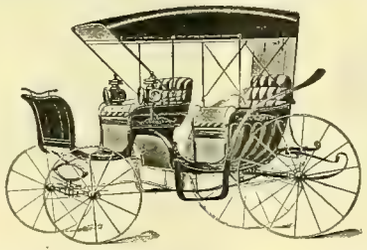

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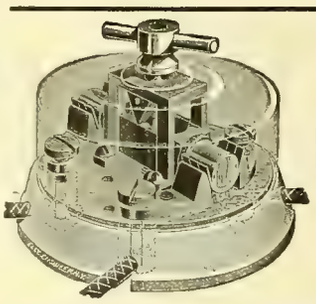

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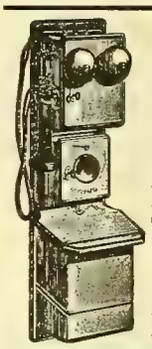

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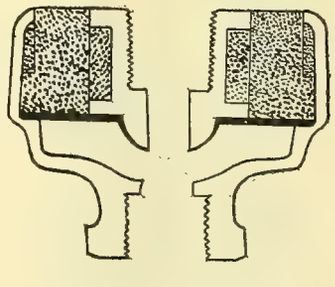

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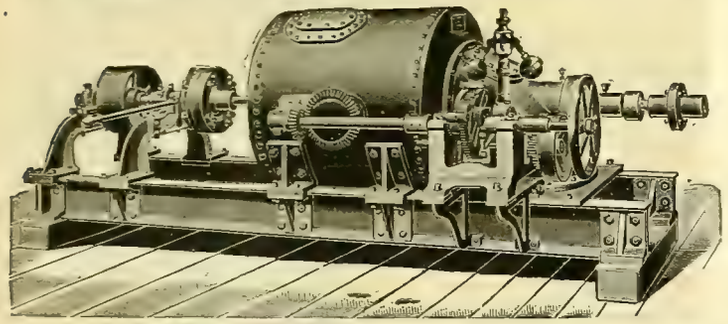

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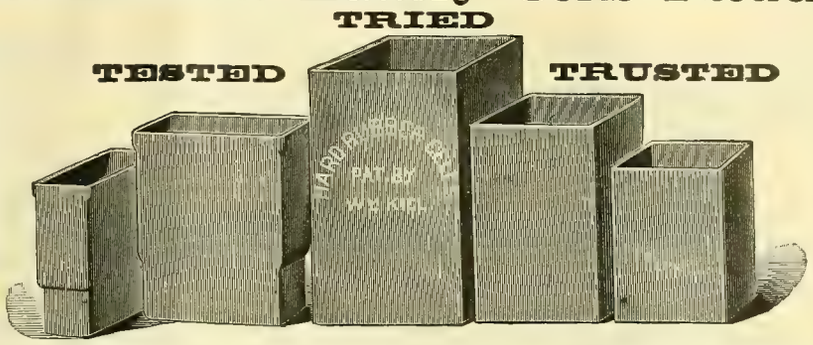


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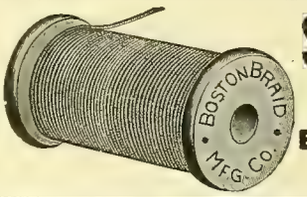


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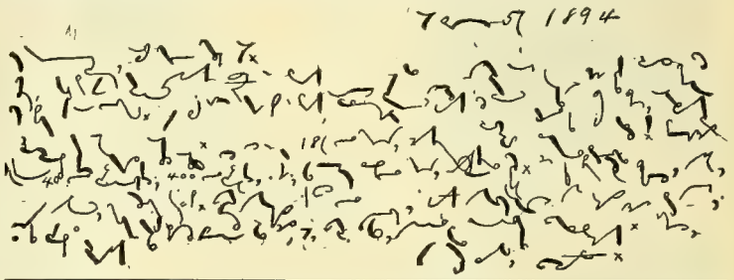


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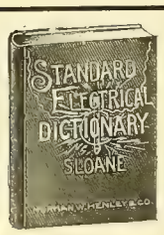


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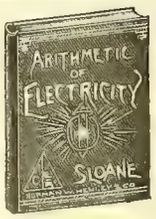


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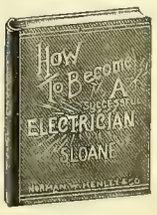


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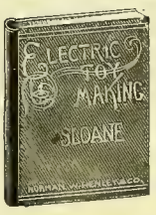


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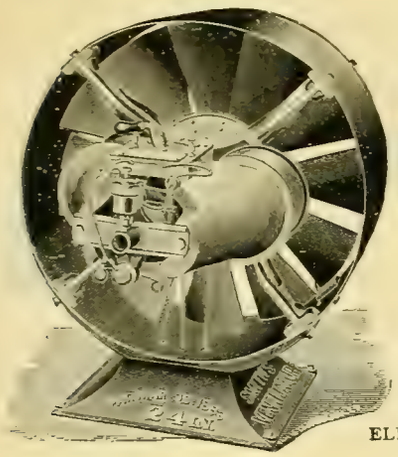

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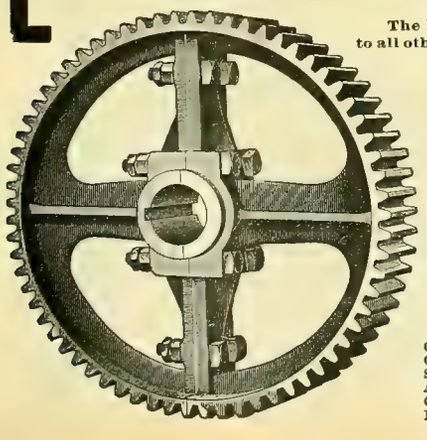

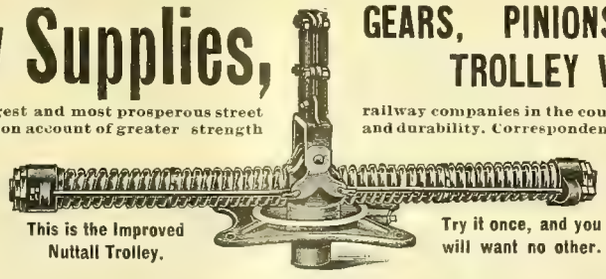

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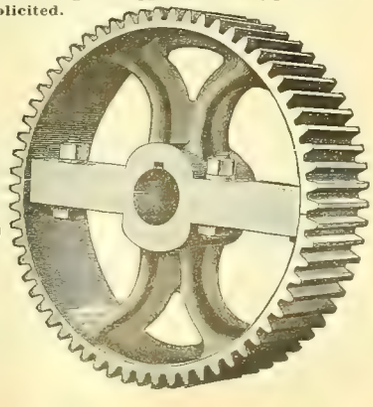

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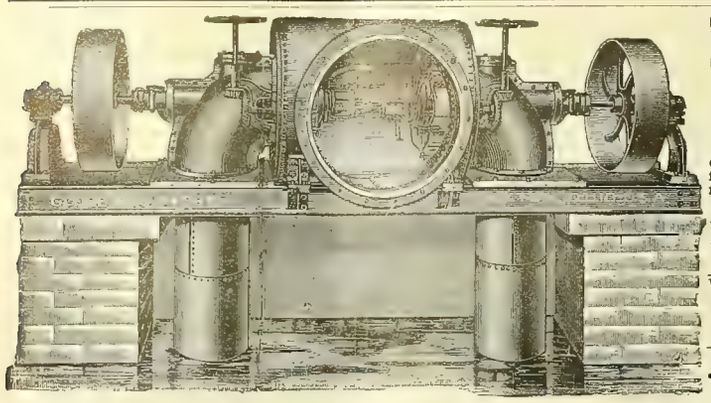

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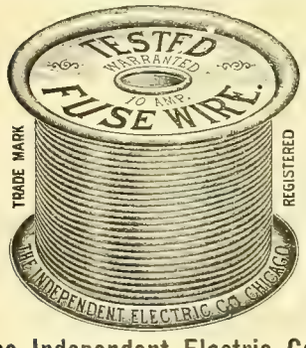


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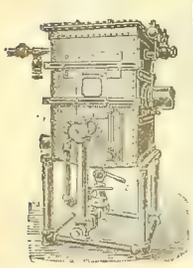

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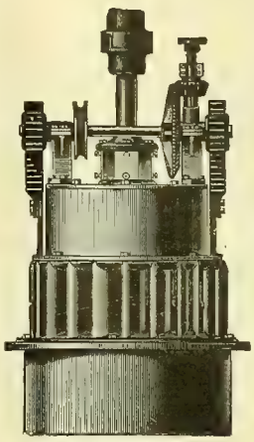

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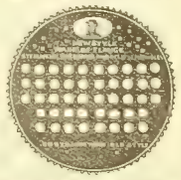

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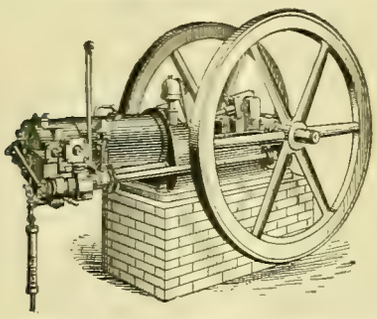

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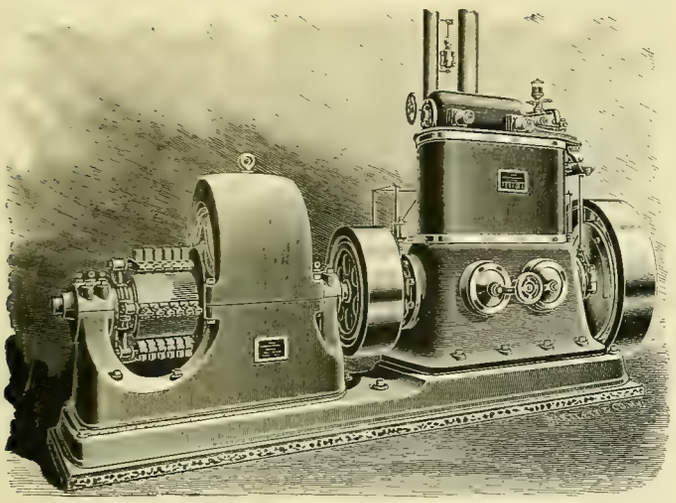

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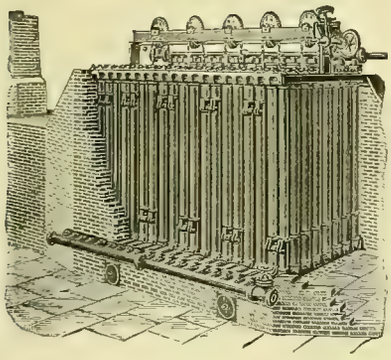

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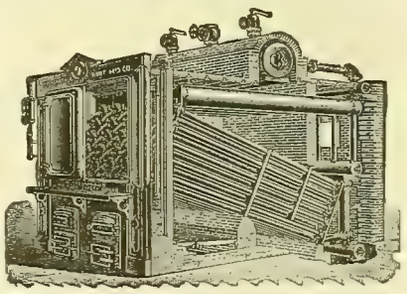

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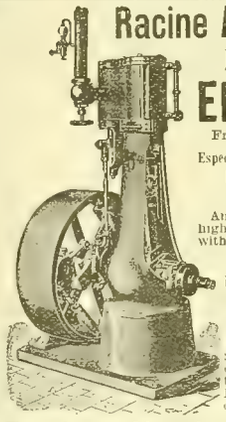

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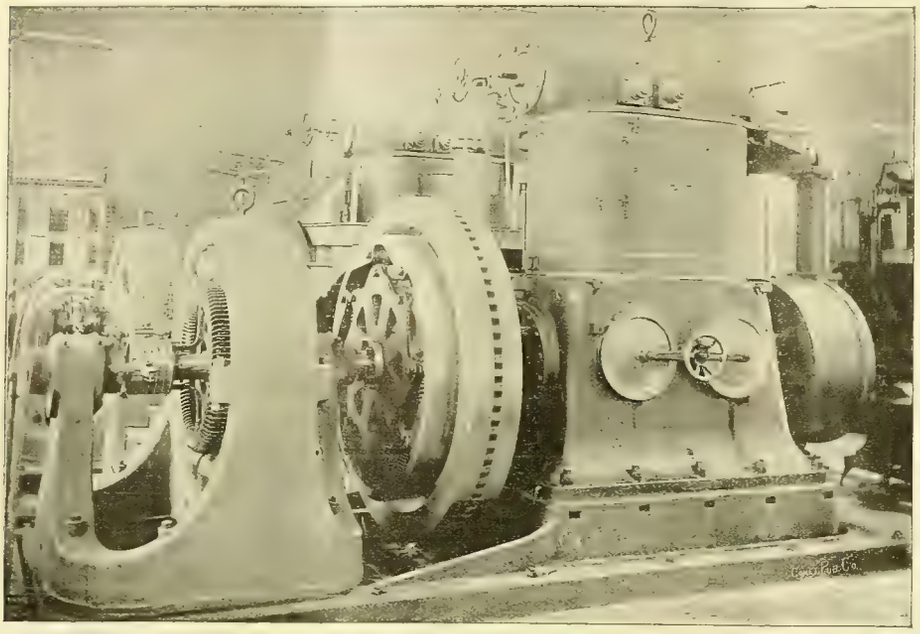

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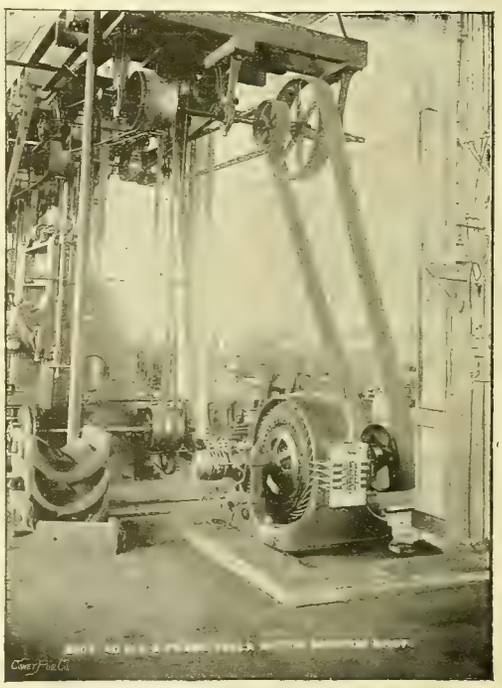

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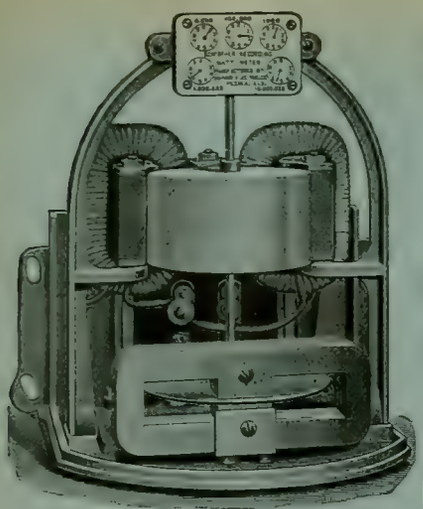

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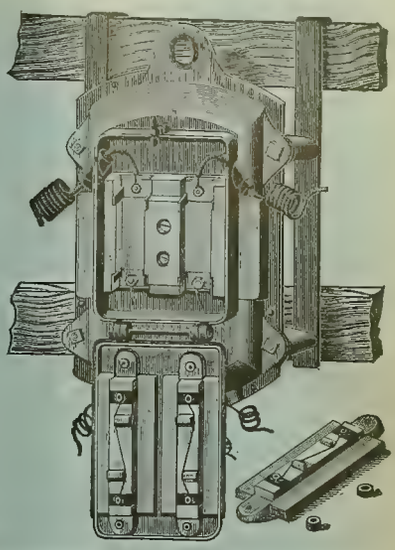

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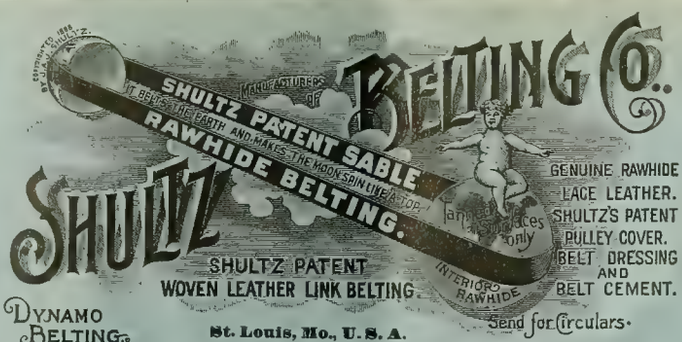


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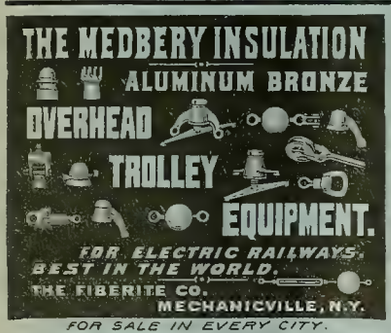


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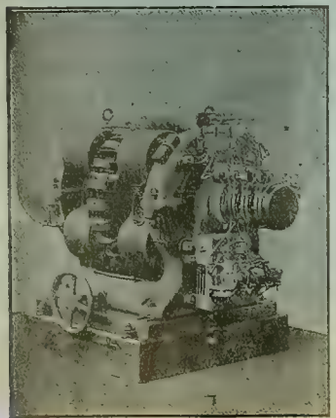

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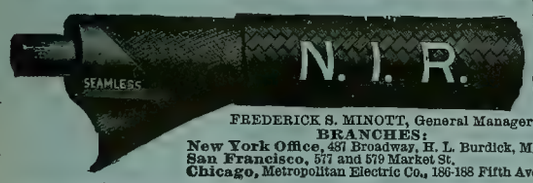


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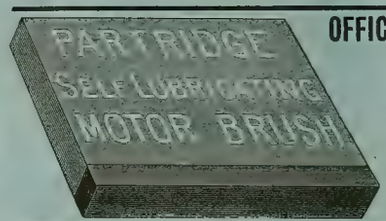


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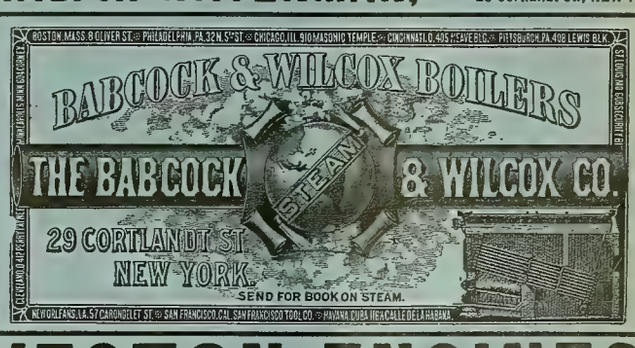


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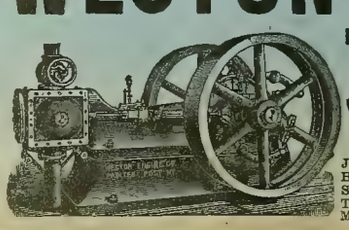

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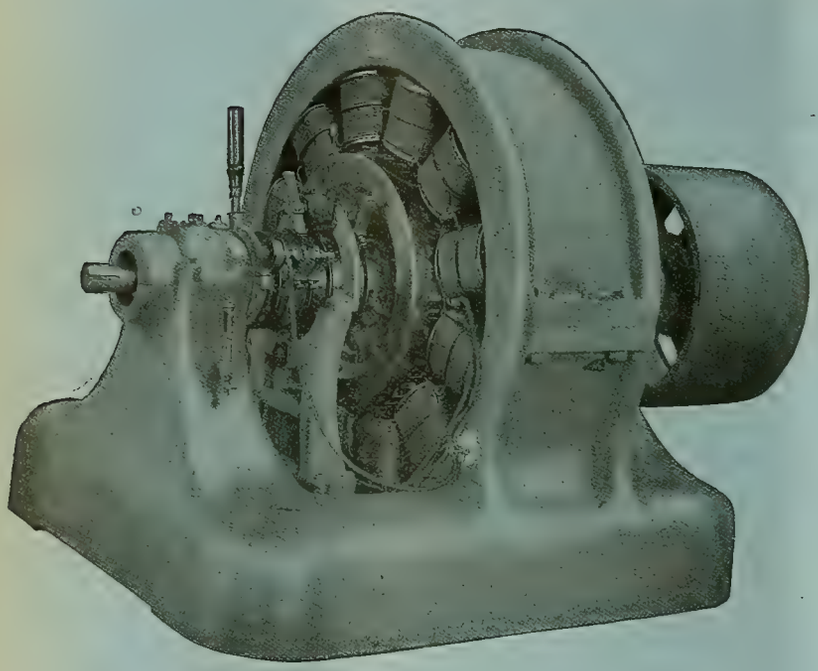

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Boswell & Co., D. E.,
Bradbury-Stone Elec. S. Co
Electric-Power Storage Co.
Electric Storage Battery Co.
Porter & Buerdorf.

**Annunciators.**
Central Electric Co.
Electric Appliance Co.
Ostrander & Co., W. R.
Partrick & Carter Co.

**Arc Lamps.**
Central Electric Co.
Corey, R. B.
Crocker-Wheeler Elec. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Helios Electric Co.
Little, F. P. Elec. C. & S. Co.
Perkins El. Switch Mfg. Co.
Standard Electric Co.
Standard Thermometer Co.
Waterman, C. H.
Westinghouse El. & Mfg. Co.

**Arc Light Cord.**
Samson Cordage Wks.

**Batteries and Jars.**
Andrae & Sons, J.
Boswell & Co., D. E.
Boynton Multivolt Batt'y Co.
Bradbury-Stone Elec. S. Co.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Central Electric Co.
Edgerton Pottery Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Hemingray Glass Co.
Leclanche Battery Co., The.
Miamisburg Electric Co.
Newton Rubber Wks.
Partrick & Carter Co.
Western Electric Co.

**Bells.**
Andrae & Sons, J.
Central Electric Co.
Electric Appliance Co.
Gillette, E. & F.
Huebel & Manger.
Ostrander & Co., W. R.
Partrick & Carter Co
Western Electric Co.

**Belting.**
Shultz Belting Co.

**Boilers.**
Abendroth & Root Mfg. Co.
Babcock & Wilcox Co.. The.
Clonbrock Steam Boiler Co.
Erie City Iron Wks.
Fulton Steam Boiler Wks.
Moyes, L. M.
Racine Hardware Co.
Weston Engine Co.

**Books, Electrical.**
Electrician Publishing Co.

**Bronze.**
Besly & Co., Chas. H.
Phosphor Bronze Sm.Co.,Ltd.

**Brushes.**
Belknap Motor Co.
Boudreaux Dyn. Brush Co.
Central Electric Co.
Partridge Carbon Co.

**Burglar Alarms.**
Central Electric Co.
Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

**Cables** (See Insulated Wires.)
**Cables, Electric** (See Insulated Wires), **Copper, Sheet and Bar.**
American Elec. Works.
Brixey, W. R.
Central Electric Co.
Chicago Ins. Wire Co.
Eastern Electric Cable Co.
Elec. Engr. & Supply Co.
Moore, Alfred F.
New York Ins. Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C.Co.
Western Electric Co.

**Carbons, Points & Plates.**
Central Electric Co.
Corey, R. B.
DeRonde & Co., A.
General Electric Co.
Hardmuth & Co., F.
Partridge Carbon Co.
Reisinger, Hugo.
Wertheim, Ed.
Western Electric Co.

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Henney Buggy Co.

**Clocks, Watchmen's.**
Southgate & Co., W. B.

**Compound.**
Standard Paint Co.
Tornberg, Edw. R.

**Conduits.**
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Interior Conduit & Ins. Co.

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Crocker-Wheeler Elec. Co.
Ft. Wayne Elec. Corporation.
Interstate Com. El. Const. Co.

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Arnold, B. J.
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Brush Electric Co.
Bryan, Wm. H.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Goltz & Sinclair.
Interior Conduit & Ins. Co.
Siemens & Halske Elec. Co.
Standard Electric Co.
United Elec Improvement Co
Walkins, Louis E.
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Western Electric Co.
Woods & Co., C. E.

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Besly & Co., Chas. H.
Miamisburg Electric Co.

**Copper Wire Bought.**
Swarts Metal Refining Co.

**Copper Wires.**
American Electrical Works.
Besly & Co., Chas. H.
Brixey, W. R.
Bunnell & Co., J. H.
Central Electric Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.
National India Rubber Co.
Okonite Co. The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Western Electric Co.

**Cordage.**
Samson Cordage Wks.

**Cranes.**
Harrington, Son & Co , E.

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Anderson, Albert & J. M.
Brady, T. H.
Brodie Electric Co.
Central Electric Co.
Central Manufacturing Co.
Electric Appliance Co.
Elec Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Nuttal Co., R. D.
Partrick & Carter Co.

**Cut-Outs and Switches.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Brodie Electric Co.
Bryant Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Edison Co.
Colgate Co., Geo. L.
Crocker-Wheeler Elec. Co.
Cutter Electrical & Mfg. Co.
Diamond Electric Co.
Eddy Elec. Mfg. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric Protection Co.
Elec. Selec. & Signal Co.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Forest City Elec. Wks.
Forsyth & Fisk.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hart & Hegeman Mfg. Co.
Huebel & Manger.
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Louisville Elec. Wks.
Nuttall Co., R. D.
Partrick & Carter Co.
Perkins El. Switch Mfg. Co.
Platt, O. S.
Viaduct Co.
Wagner Elec. Mfg. Co.

**Dynamos.**
Brush Electric Co.
Central Electric Co.
Colburn El. Mfg. Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Elliott-Lincoln Elec. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Roth Bros. & Co.
Royal Electric Co.
Siemens & Halske Elec. Co.
Standard Electric Co.
Walker Mfg. Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

**Economizers.**
Fuel Economizer Co.

**Electric Railways.**
Brush Electric Co.
General Electric Co.
Siemens & Halske Elec. Co.
Westinghouse El. & Mfg. Co.

**Electrical and Mechanical Engineers.**
Arnold, B. J.
Bain, Foree.
Bryan, Wm. H
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Ford, Owen.
Goltz & Sinclair.
Thayer Electric Co.
Walkins, Louis E.
Woods & Co., C. E.

**Electrical Instruments.**
Anderson, Albert & J. M.
Brodie Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Diamond Electric Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Interior Conduit & Ins. Co.
Nuttall Co., R. D.
Partrick & Carter Co.
Platt, O. S
Queen & Co. Inc.

**Electrical Specialties.**
Clark El. Specialty Mfg. Co.
Electric Protection Co.
Interstate Com. El. Const Co.
S. K. C. Specialty Co.

**Electroliers, etc.**
Edwards, W. S. Mfg. Co.

**Electro-Plating Mach'y.**
Besly & Co., Chas. H.
Colburn El. Mfg. Co.
General Electric Co.

**Engines, Gas.**
Case, J. I., T. M. Co.
Otto Gas Engine Wks.

**Engines, Steam.**
Ball & Wood Co., The.
Chuse & Co., J. F.
Erie City Iron Wks.
Racine Hardware Co.
Westinghouse Machine Co.
Weston Engine Co.

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Illinois Eng. Co.

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Diehl & Co.
Dieterichs-Warwick El. Co
Interior Conduit & Ins. Co.
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Goubert Mfg. Co.

**Fibre.**
Butler Hard Rubber Co.
Vulcanized Fibre Co.

**Files.**
Barnett Co., G. & H.

**Fire Alarms.**
Partrick & Carter Co.
Western Electric Co.

**Fuse Wire.**
Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.

**Gas Lighting, Electric.**
Partrick & Carter Co.

**Gears.**
Besly & Co., Chas. H.
Nuttall Co., R. D.

**General Elec. Supplies.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Besly & Co., Chas. H.
Brodie Electric Co.
Bryant Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Edison Co.
Colgate Co., Geo. L.
Cutter Electrical & Mfg. Co.
Dieterichs-Warwick El. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric Protection Co.
Elliott-Lincoln Elec. Co.
Farr Tel. & Const. Supply Co.
Forest City Elec. Wks.
Garton-Daniels Elec. Co.
General Electric Co
Goltz & Sinclair.
Hayes, Fyfe Co.
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Louisville Elec. Wks.
Mason El. Equip Co.
Metropolitan Electric Co.
Morris & MacCurdy.
Partrick & Carter Co.
Perkins El. Switch Mfg. Co.
Platt, O. S.
Queen & Co Inc.
Sioux City Brass Works.
S. K. C. Specialty Co.
Standard Tel. & Elec. Co.
Thayer Electric Co.
Viaduct Co.

**Globes and Electrical Glassware.**
Edgerton Pottery Co.
Edwards, W. S. Mfg. Co.
Hemingray Glass Co.

**Graphite Specialties.**
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.

**Hard Rubber Goods.**
Butler Hard Rubber Co.
Fiberite Co., The.
Mason El. Equip. Co.
Newton Rubber Wks.

**Insulators and Insulating Materials.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Brixey, W. R.
Brodie Electric Co.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Central Electric Co.
Chicago Ins. Wire Co.
Crocker-Wheeler Elec. Co.
Cutter Elec. & Mfg. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Empire China Works.
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Fiberite Co., The.
Hart & Hegeman Mfg. Co.
Hemingray Glass Co.
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Johns Mfg. Co., H. W.
Little, F. P. Elec. C. & S. Co.
Louisville Elec. Wks.
Munsell & Co.. Eugene.
National India Rubber Co.
Newton Rubber Wks.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Platt, O. S.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Paint Co.
Standard Underground C.Co.

**Insulated Wires and Cables—Magnet Wire.**
American Electrical Works.
Brixey, W. R.
Brodie Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Ins. Wire Co.
Eastern Electric Cable Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
General Electric Co.
Independent Electric Co.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C.Co.

**Lamps, Incandescent.**
Am. Electrical Mfg. Co.
Buckeye Electric Co.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Globe Electric Light Co.
New York & Ohio Co.
Partrick & Carter Co.
United Elec. Imp. Co.
Westinghouse Elec. & Mfg Co.

**Lightning Arresters.**
Colgate Co., Geo. L.
Diamond Electric Co.
Electric Appliance Co.
General Electric Co.
Garton-Daniels Elec. Co.

**Magnet Wire.**
(See Insulated Wires.)

**Mechanical Machinery**
Besly & Co., Chas. H.
Harrington, Son & Co., E.
Lukens Iron & Steel Co.
Manistee Iron Wks. Co.

**Mica.**
Johns Mfg. Co., H. W.
Munsell & Co.. Eugene.

**Mining Apparatus, Elec.**
General Electric Co.
Independent Electric Co.
Westinghouse El. & Mfg. Co.

**Motors.**
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Belknap Motor Co.
Brush Electric Co.
Central Electric Co.
Colburn El. Mfg. Co.
Crocker-Wheeler Elec. Co.
Dieterichs-Warwick El. Co.
Eddy Elec. Mfg. Co.
Elec. Engr. & Supply Co
Elliott-Lincoln Elec. Co.
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General Electric Co.
Interior Conduit & Ins. Co.
Roth Bros. & Co.
Royal Electric Co.
Sioux City Brass Works.
Standard Electric Co.
Stanley Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
Walker Mfg. Co.
Westinghouse El. & Mfg. Co.

**Packing.**
Besly & Co., Chas. H.
Garlock Packing Co.

**Paints.**
Morris & MacCurdy.
Standard Paint Co.

**Patents.**
Gooch, Chas. J.

**Phosphor Bronze.**
Phosphor Bronze Sm.Co. Ltd

**Pianos and Organs.**
Beethoven Piano & Organ Co

**Platinum.**
Baker & Co.

**Poles.**
Morris, Tasker & Co.
Nuttall Co., R. D.
Valentine-Clark Co.

**Porcelain.**
Empire China Works.
General Electric Co.
Hemingray Glass Co.

**Publishers, Electrical.**
Electrician Publishing Co.

**Pumps.**
Manistee Iron Wks. Co.

**Push Buttons.**
Central Electric Co.
Electric Appliance Co
Partrick & Carter Co.

**Rheostats.**
Central Electric Co.
General Electric Co.
Hayes, Fyfe Co.

**Sal Ammoniac.**
Klipstein & Co., A.

**Silk Braid.**
Boston Braid Mfg. Co.

**Speaking Tubes.**
Central Electric Co.
Electric Appliance Co.
Ostrander & Co., W. R
Partrick & Carter Co

**Speed Indicators**
Besly & Co., Chas. H.
Colgate Co., Geo. L.
Diamond Electric Co.
Queen & Co. Inc.

**Steam Heating.**
Goubert Mfg. Co.
Webster & Co., Warren.

**Storage Batteries.**
Boswell & Co., D. E.
Bradbury-Stone Elec. S Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Porter & Buerdorf.

**Street Cars.**
Brill, J. G. Co.

**Tapes, Insulating.**
American Electrical Works.
Brixey, W. R
Central Electric Co.
Chicago Ins. Wire Co.
Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Paint Co.

**Telegraph Apparatus.**
Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

**Telephones and Telephone Material.**
Andrae & Sons, J.
Central Electric Co.
Farr Tel. & Const. Supply Co.
Forsyth & Fisk.
Gillette, E. & F.
Gustafson, W. A.
Mo Telephone Mfg. Co
Partrick & Carter Co.
Phila. Telephone Co.
Public Telephone Co.
Standard Tel. & Elec. Co.
U. S. Tel. Const. Co.
Universal Telephone Co.
Viaduct Co.
Western Electric Co.
Western Tel. Const. Co.

**Transformers.**
Central Electric Co.
Diamond Electric Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hornberger Elec. Mfg. Co.
Louisville Elec. Wks.
Royal Electric Co.
Stanley Electric Mfg. Co.
Wagner Elec. Mfg. Co.

**Trolley Cord.**
Samson Cordage Wks.

**Trucks, Electric Car.**
General Electric Co.
Westinghouse El. & Mfg. Co.

**Turbine Wheels.**
Dayton Globe Iron Works Co.
Leffel & Co., Jas.
Smith, S. Morgan.
Stillwell-Bierce & Smith-Vaile Co.

**Universities.**
Chi. Shorthand Institute.
Int. Corr. Schools.
Rose Poly. Institute.

**Water Wheels.**
Leffel & Co., Jas
Smith, S. Morgan.

**Wire, Bare.**
Anderson, Albert & J. M.
Besly & Co., Chas. H.
Bishop Gutta Percha Co.
Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
Independent Electric Co.
National India Rubber Co.
Nuttall Co., R. D.
Okonite Co., The.
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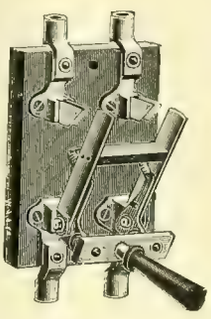
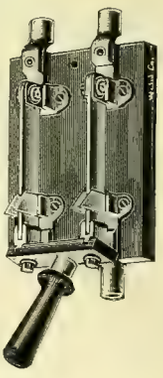


Medbery Medbery 

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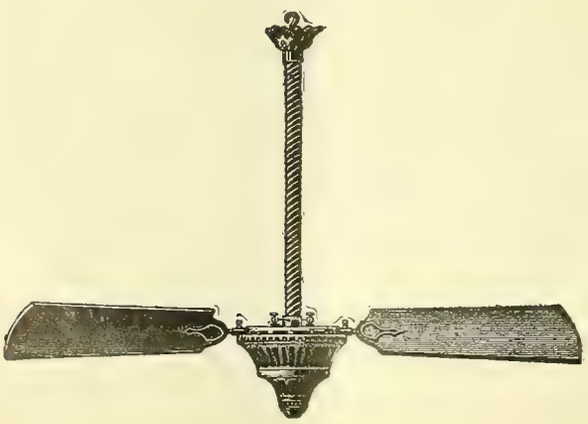

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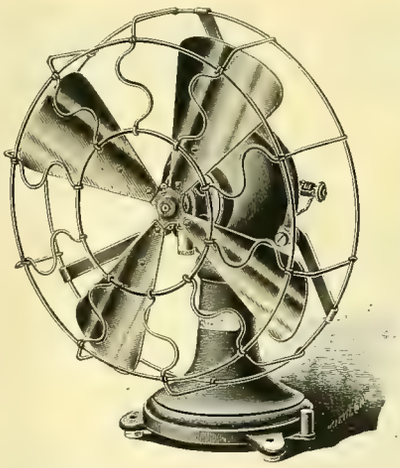
If the weather takes a calorific turn, and it's likely to do that very thing; or the "proceedings" wax a trifle tiresome, just run over long enough to regain your equilibrium in the reposeful coolness of a **Lundell Breeze.** Competent critics have declared our salesrooms the coolest in Chicago, it's all mechanical however and not due to a lack of warm hospitality—you will find plenty of that in various ways. You will also find a complete installation of Interior Conduit, showing its flexibility and adaptation to every form of work and proving its claim to superiority over every other method of interior distribution.



Electric House Goods, Central Station Supplies and Electric Railway Materials are displayed in prodigal profusion. Cases of Testing Sets and Meters, gems of the instrument maker's art, are shown. And other goods that come in cases that really must be seen to be appreciated. We are "at home" all day—suit your own convenience.

## Central Electric Company,

**173=175 Adams St.,**

**CHICAGO.**

————BRANCHES:————

St. Louis, Mo., **Southern Electrical Supply Co.**

**New Orleans, W. M. Brooke, 1010 Canal St.**

Kansas City, Mo., **Gate City Electric Co.**


## After Dinner Yarns.

### Obeying Orders.

The story is told that when, after the second battle of Bull Run, Gen. Sickles assumed command of a division of the army of the Potomac, he gave an elaborate farewell dinner to the officers of his old Excelsior Brigade.

"Now, boys, we will have a family gathering," he said to them, as they assembled in his quarters. Pointing to the table, he continued, "Treat it as you would the enemy."

As the feast ended, an Irish officer, Capt. Byrnes, was discovered by Sickles in the act of stowing away three bottles of champagne in his saddle-bags.

"What are you doing, sir?" gasped the astonished General.

"Obeying orders, sir," replied the Captain in a firm voice. "You told us to treat that dinner as we would the enemy, and you know, General, what we can't kill we capture."

### Chauncey's New Story.

Chauncey M. Depew has a new story—one which he won't tell the next time he goes to Chicago. Here it is:

"There was once a prominent man in Chicago who, like all others out there, had a very exalted opinion of his own city. He died, and when he reached his eternal home he looked about him with much surprise and said to the attendant who had opened the gate for him, 'Really, this does great credit to Chicago. I expected some change in heaven.'

"The attendant eyed the Chicagoan a second and then observed, 'This isn't heaven.'"

### There Was.

He (resuming his seat after a brief visit outside)—"What an atmosphere of realism there is about this play!"

She—"Yes. Smells like cloves."

### Reed and His Gloves.

Tom Reed never wears a silk hat. He bought one six years ago and braved public sentiment beneath it for nearly a fortnight, but he couldn't bear the pressure any longer than that. It made him uncomfortable. It didn't fit the bumps on his head, and altogether he didn't think it harmonized with the contour of his face or of his body. Hats have always been a source of trouble and annoyance to him. When he first came to Congress he wore a little saucer-like arrangement, with a narrow brim, that made his face look twice its natural size, and gave him generally a schoolboy air. His friends weaned him of that, but they have never been able to induce him to give any particular attention to dress.

It is only lately that Mr. Reed has taken to wearing gloves, except in the coldest weather. The day the print of the tariff bill, with its innumerable committee amendments appeared. Reed walked into the House, hung up his hat in the cloak-room, and began to wander about the floor, conspicuously holding the bill before him in his gloved hands.

Baker of New Hampshire caught on to the queer combination and whispered hurriedly to Boutelle, "For heaven's sake speak to Reed! He'll be wandering around here absent-mindedly all day with his gloves on if you don't."

Boutelle sidled up to his big colleague and began to pull his coat sleeve. "Get back into the cloak room, Tom," he whispered, "and pull off your gloves. You'll have the whole house laughing at you."

Reed turned solemnly upon the Bangor man and held up the bill he was carrying. "Charles," he said, "why do you speak with so little consideration? Can't you see that I can't trust myself yet to handle this thing without gloves?"

### A Field of Relics.

"Yes, sir," said the Georgia land agent to the northern prospector, "you kin plow up a peck of bullets here every week."

"But are they genuine?"

"You bet they air! Don't I buy 'em an' plant 'em myself? An right where you're a-standin' is a bombshell that I traded a cow for an' it's gittin' jest as rusty as if it wuz throwed thar by the war!"—Atlanta Constitution.

### A New Beer.

There is an intelligent actor here, who is improving his idle time before next season in selling or trying to sell, a fine Shakespeare. The other day he called on a good natured but rather dense German who keeps a beer hall on Dearborn street.

"Good day," he said to the ruddy proprietor. "I am selling Shakespeare."

"Nein," said the German. "I vant to make no change. I haf already Pabst peer und Schlitz peer, and I don't dink I vant Chake's peer."

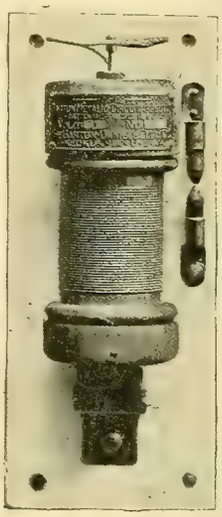
"No, no, my friend," protested the actor-book agent, "you misunderstand me. This is a book."

"O, doss all right," said the German. "I haf bock, too."

SAY,

# DO YOU USE THE GARTON ARRESTERS?

IF NOT,



You don't know that feeling of security that comes to all that have a full equipment.

"Safe in the storm that may gather,
Tho' the blue juice may come thick and fast;
Wild and infernal the weather,
The Garton's protect till the last."

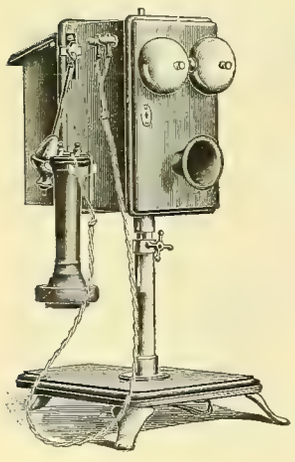
**NO INDUCTIVE RESISTANCE. NO PIVOTS OR HINGES.**
**NO FUSES TO BLOW. REQUIRE NO ATTENTION. ARE ALWAYS READY.**

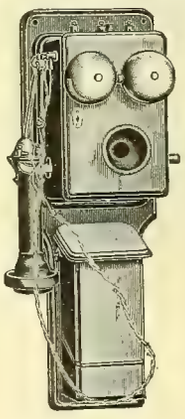
Don't try to get through the balance of the season without them. They don't cost as much as armatures, and will last you an indefinite time. Write to-day.

## GARTON-DANIELS ELECTRIC CO.,

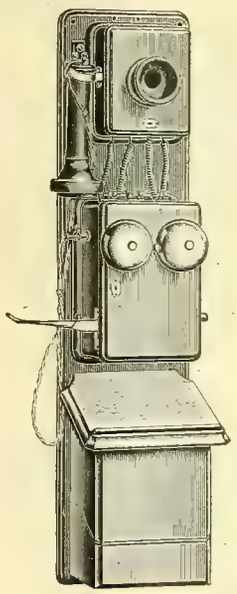
**KEOKUK, IOWA, U. S. A.**

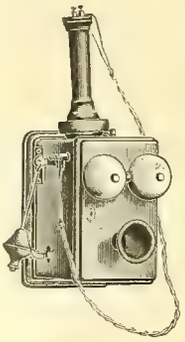
**N. B. OUR PRICES ARE RIGHT.**

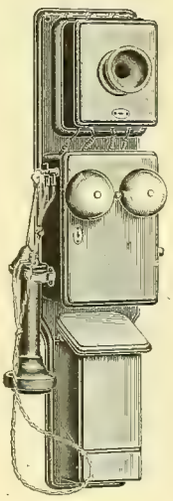


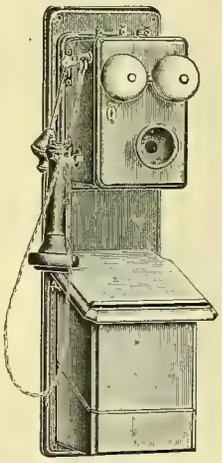


**Patented**
**May 30, 1893.**
**Dec. 25, 1894.**
**Jan. 1, 1895.**









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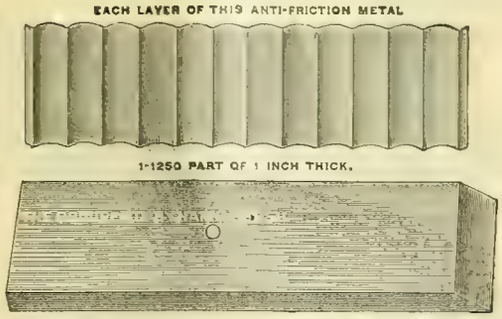


The Boudreaux Dynamo Brush Co. NO WOVEN WIRE.

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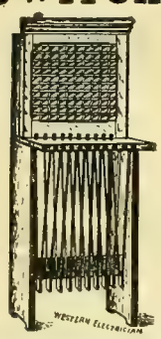

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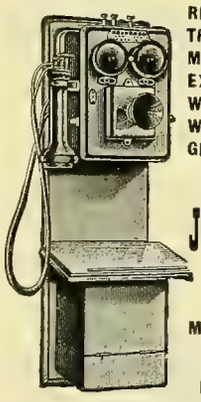

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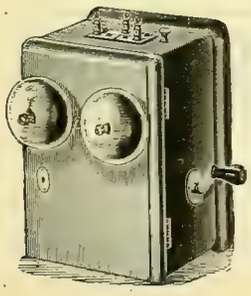

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No adjustment required.
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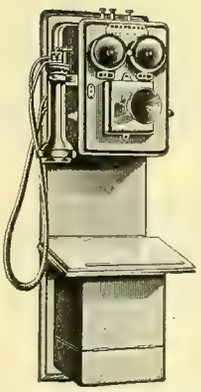
**For Simplicity, small dimensions, entire multicontact, and powerful transmission it has no equal. Adopted by Governments, Exchanges and Railways in EUROPE, ASIA and SOUTH AMERICA.**



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Have been adopted by Telephone Exchanges, Leading Railway Companies and Corporations, throughout the United States, for long distance work after severe comparative tests.

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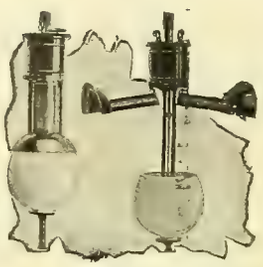

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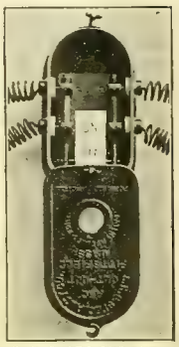

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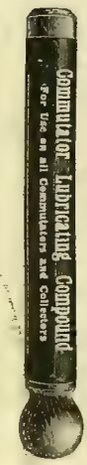


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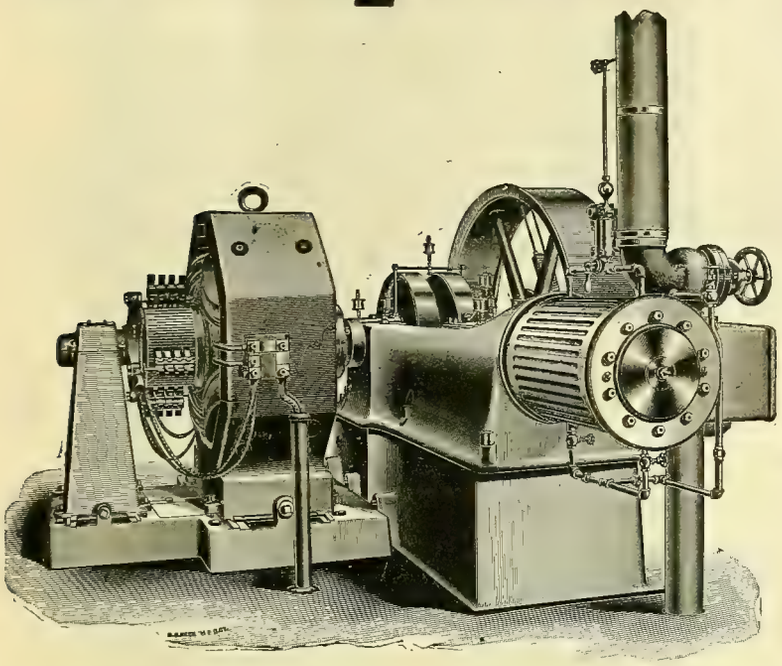

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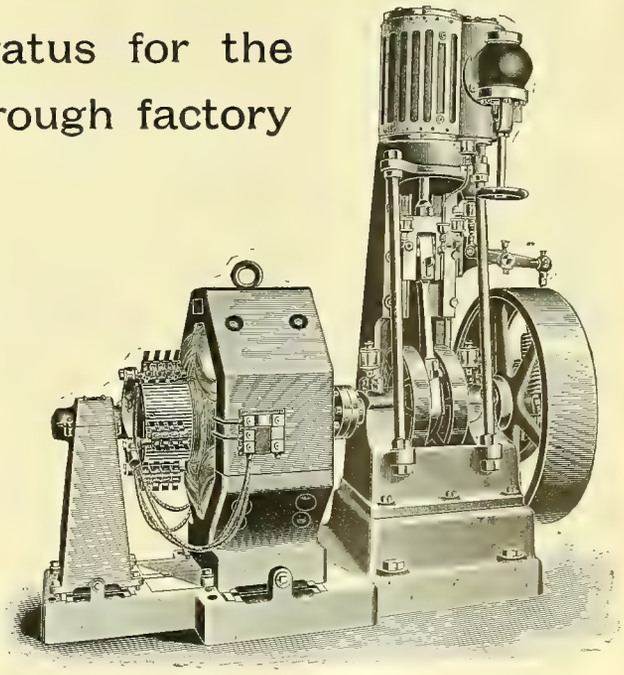

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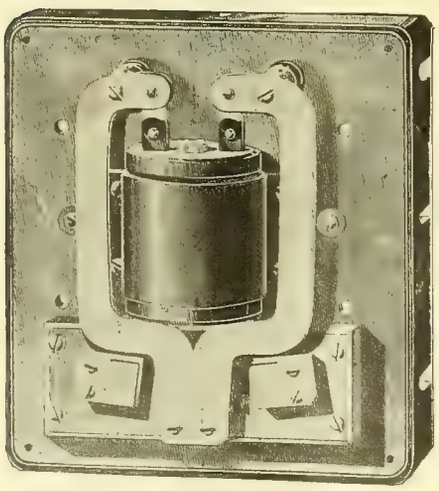

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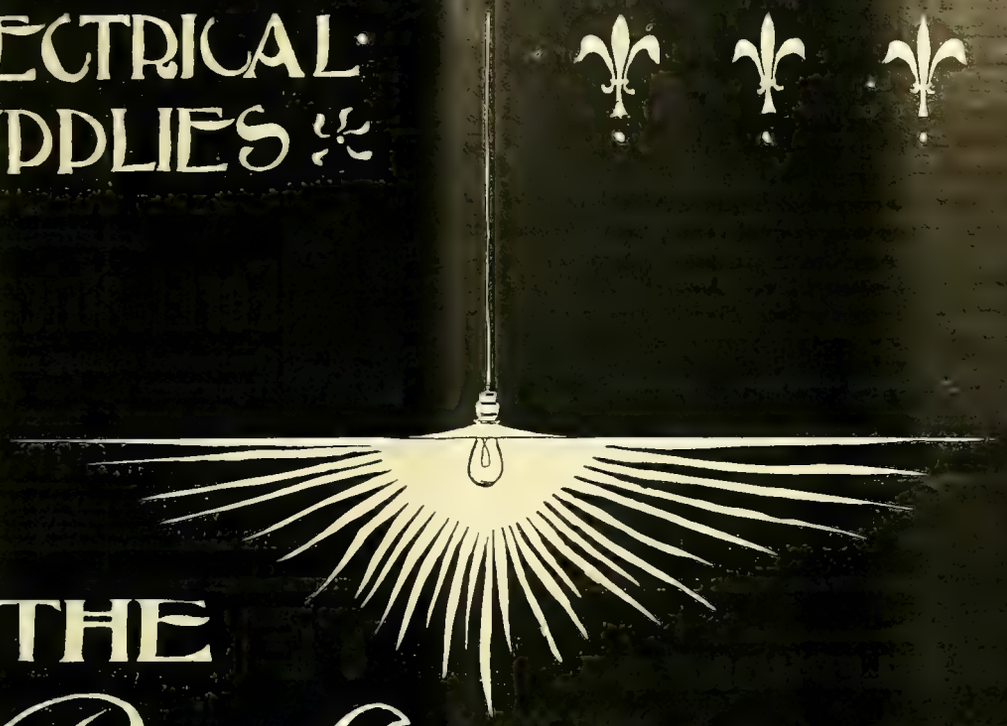

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| HOURS | 0 | 100 | 200 | 300 | 400 | 500 | 600 | 800 | 1000 |
|---|---|---|---|---|---|---|---|---|---|
| CANDLE POWER | 16 | 17.2 | 18.2 | 19.4 | 17.2 | 16.3 | 16.1 | 15.7 | 15.0 |
| EFFICIENCY [WATTS P. C.P.] | 3.44 | 3.38 | 3.34 | 3.28 | 3.36 | 3.43 | 3.44 | 3.47 | 3.51 |

These figures do not represent CHANCE results but are guaranteed by us as characteristic of our LAMPS.

## ELECTRIC APPLIANCE COMPANY

## 242 MADISON ST. - CHICAGO.

# Do You Recall

. . . . The well-known fact that a combination once existed that proposed to dictate its own terms to every central station, to every owner of an electric lighting system, and where an inclination was shown not to accede to the cut-throat demands to enter the local field and destroy the business years and capital had built up? Well, we had the pleasure of setting the pace for that combination to execute its retrograde movement by, and we have enjoyed the fun of seeing it swallow its own threats and go down into history as a picturesque failure in the bluffing line. And now we are securing orders from its own licensees for the Standard system of electric lighting. Why? Because no other system is so simple, so efficient electrically, so perfect mechanically, so moderate in first cost, with maintenance charges so small. As there can only be one "best," so there is only one *Standard* to judge the imitators by. We build that Standard.

Study our book: 'twill put money in thy purse. Mailed free.

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For Arc Light and Trolley Cord.

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For Traction Work, Electric Lighting, Electric Launch, Telegraph, Phonograph, Surgical, and for all purposes where Light and Power are required.

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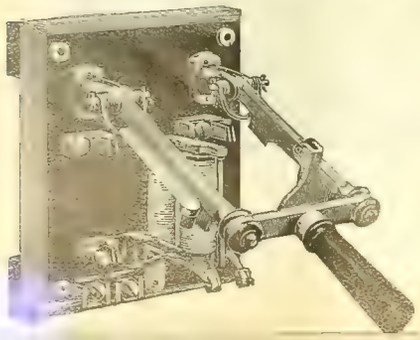
QUALITY UNEQUALED.

FACTORY PRODUCTION TRIPLED.

## INCANDESCENT LAMPS

Monadnock Building, Chicago. **THE BUCKEYE ELECTRIC CO., Cleveland, O.**

# MOTOR ARMATURES COST MONEY



You can prevent them from burning out by using

## THE BRODIE AUTOMATIC MOTOR-SWITCH.

It combines in one piece of apparatus a double-pole switch, adjustable limit-switch and automatic cut-out, and instantly disconnects the motor whenever it is overloaded and whenever the circuit fails from any cause.

Agents wanted in all sections of the country.

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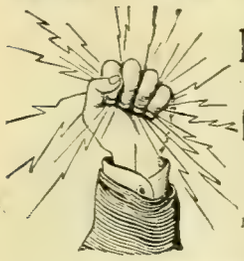

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ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,

Railway Feeder and Trolley Wire,

AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.

CABLES FOR AERIAL AND UNDERGROUND USE.

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CHICAGO STORE, F. E. Donohoe, 241 Madison St.
MONTREAL BRANCH, Eugene F. Phillips' Electrical Works.

## No. 11 DOUBLE GROOVE PONY INSULATOR.

**Can be Used for Transposing.**

The points or teats on the lower rim of the petticoat attracts the water on the outer surface of the insulator into drops. The water drops from these points on to the cross-arm, thereby preventing the moisture from creeping up on the inner petticoat, and thence to the pin. Owing to the great success of our Patent Teat Insulator in Telegraph Work, where the efficiency of the Insulator has proven to be more than twice that of the ordinary Insulator, we have concluded to apply the device to all Insulators for Telegraph, Telephone and Street Railway Work.

Standard Screw Glass Insulators,
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Colored Glass Insulators to designate different currents.

**WORK ON SPECIAL DESIGNS A FEATURE.**

Send Model or Drawing and we will furnish estimates.

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# "CLARK" WIRE.

TRADE MARK.

For Switchboard, Railway and Motor use, we make all sizes of Stranded and Flexible Wire and Cables with Clark's Insulation.

The Clark Wire has been before the public and in use for the past nine years, and has met with universal favor. Thousands of miles of this wire have been sold, and are in use throughout the United States and Foreign Countries, and the demand for it is constantly increasing, because it always gives perfect satisfaction.

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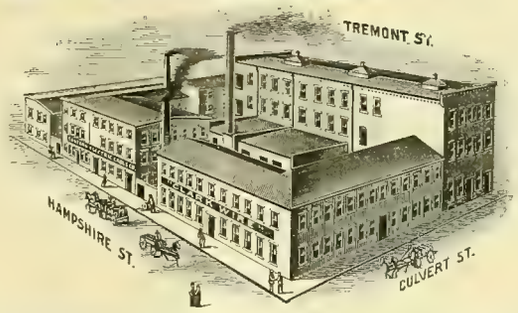


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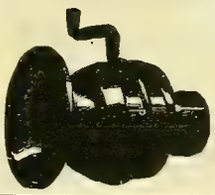

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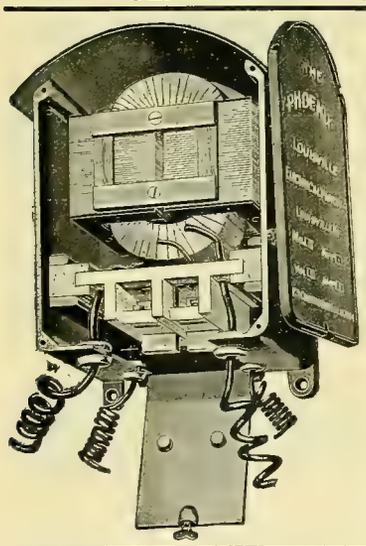

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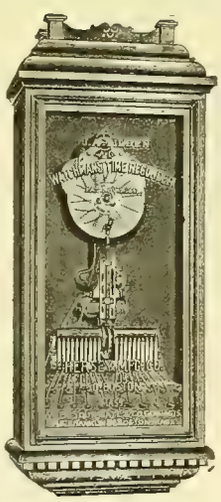

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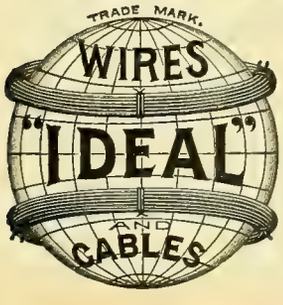


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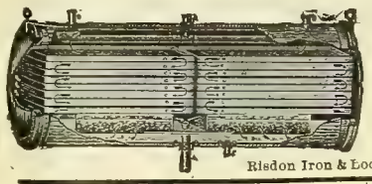

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Notice is hereby given that the Council of the City of Springfield, Mo., will receive sealed proposals up to eight o'clock P. M. of Friday, the twenty-sixth day of July, 1895, for furnishing said city with one hundred and fifty Arc Electric Lights, of 2,000 candle power, to burn on moonlight schedule, except that lights must burn on all dark and cloudy nights.

Proposals must state prices at which the above lights will be furnished on a one, three or five year contract, and give the maximum prices to be charged consumers for Arc and Incandescent Lights for commercial and domestic use.

Each proposal must be accompanied by a detailed description of the plant proposed to be used for furnishing said lights, and no proposal will be considered that is not accompanied by such description.

Each proposal must be accompanied by a certified check for the sum of One Thousand Dollars, ($1,000.00), conditioned that the bidder will enter into contract in compliance with such proposal if accepted.

The City Council reserves the right to reject any and all proposals.

J. FENTON, Mayor.

ATTEST:
G. W. HACKNEY, City Clerk.

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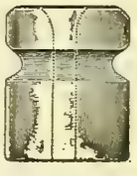

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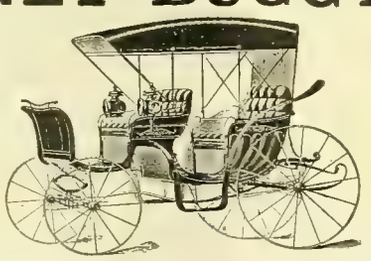

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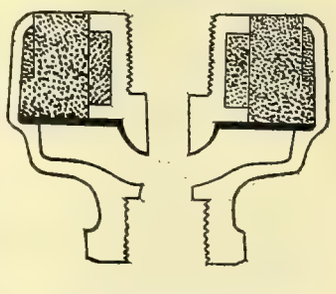

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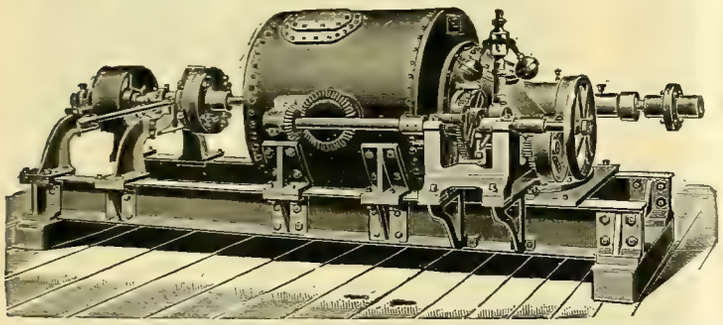

Cylinder or Register Gate—Close Regulation and High Efficiency at Full and Partial Gate.

The attention of ELECTRIC COMPANIES is called to this **CELEBRATED WATER WHEEL** as particularly adapted to their use, on account of its **remarkably steady motion, high speed and great efficiency and large capacity** for its **diameter,** being **double** the **power** of most wheels of the same diameter. It is used by a number of the leading electric companies with great satisfaction. In the economical use of water it is without an equal, producing the highest per cent of useful effect **guaranteed.**

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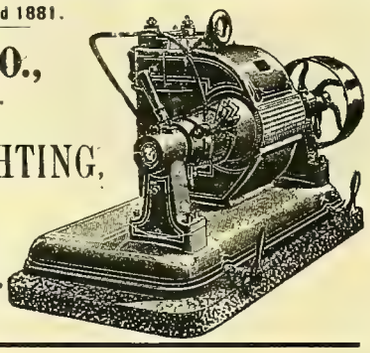

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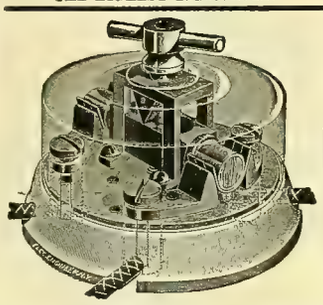

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HAVE COME AND GONE, BUT THE

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TRY THEM AND WONDER WHY YOU EVER USED ANY OTHER.

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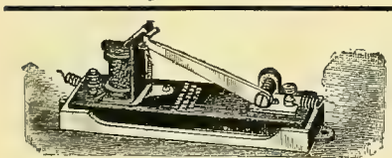

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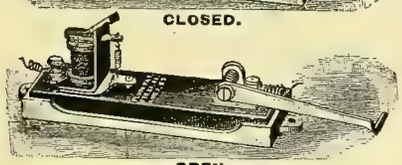

OPEN.

**Regular Size, 6 inches long, 2¾ inches high, 1 to 1¼ inches wide.**

In a suit brought against F. Stevens by the Cutter Company, claiming an infringement on an Electric Flush Switch, it was decided in his favor by the United States Court in December last, the Court dismissing the case with costs.

---

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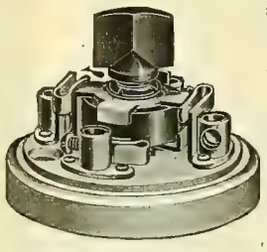

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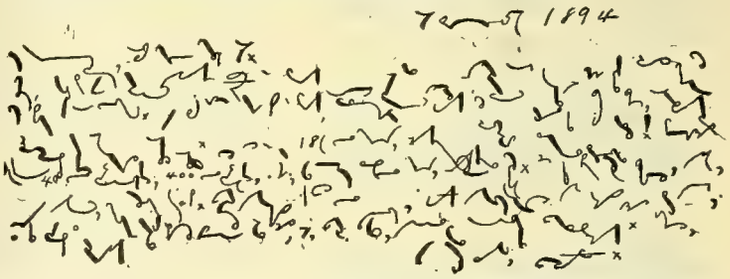

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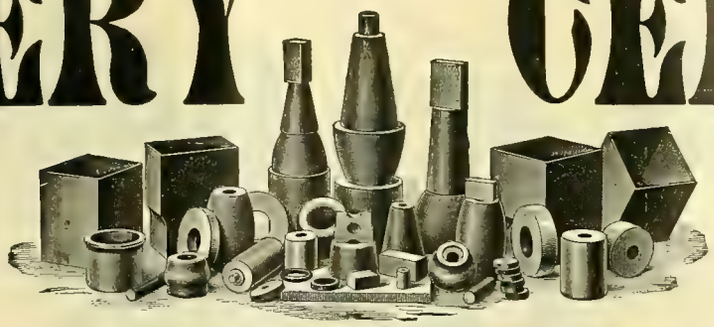

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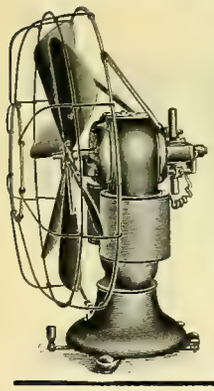

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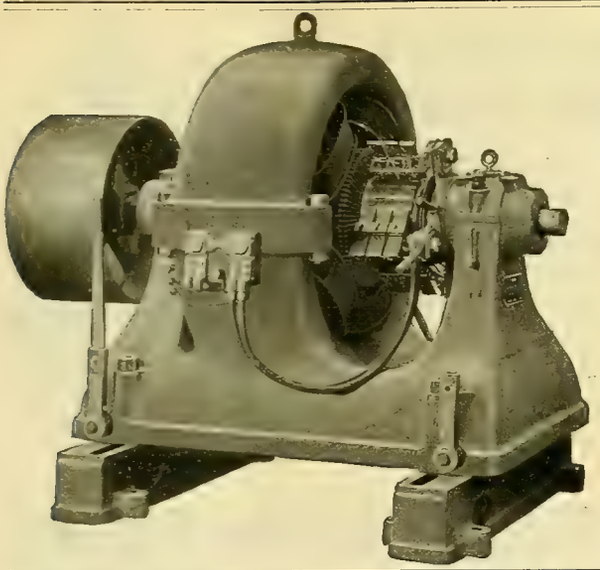

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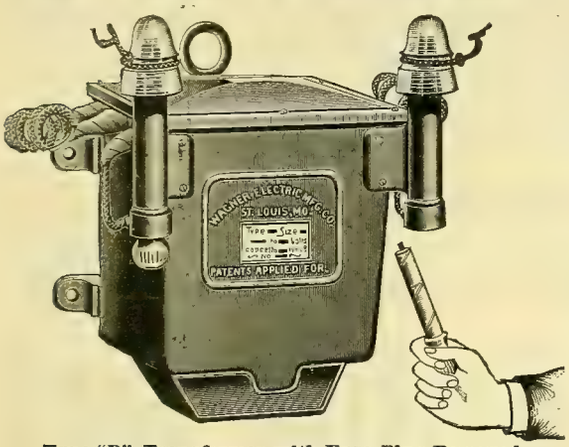


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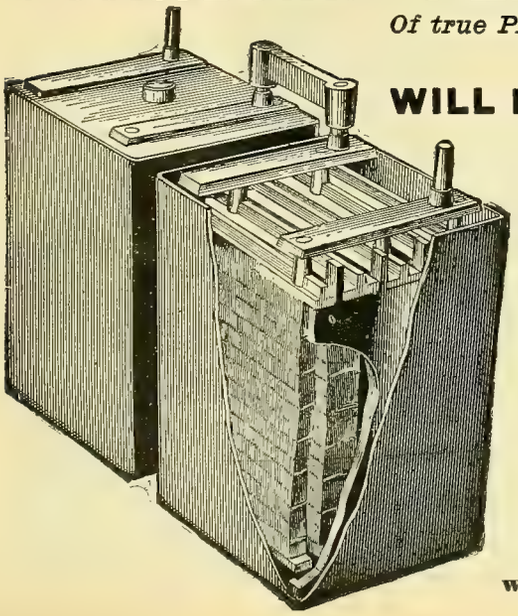

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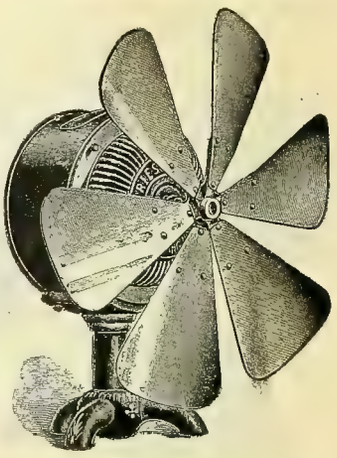

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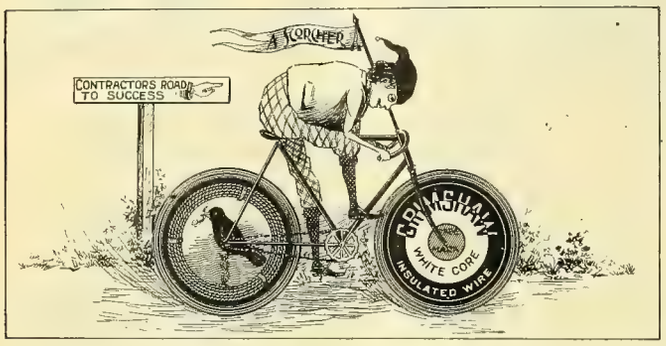


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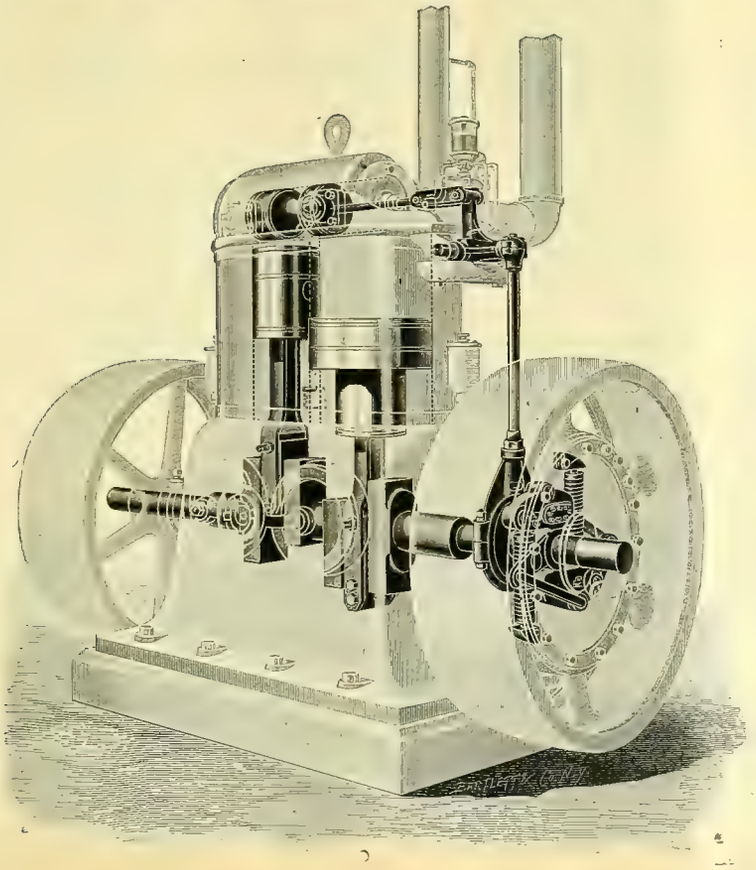

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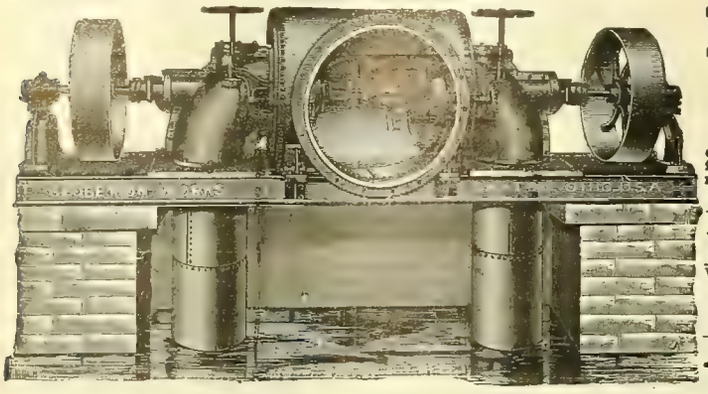

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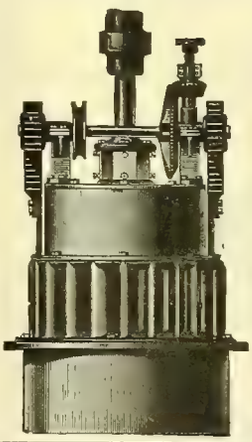

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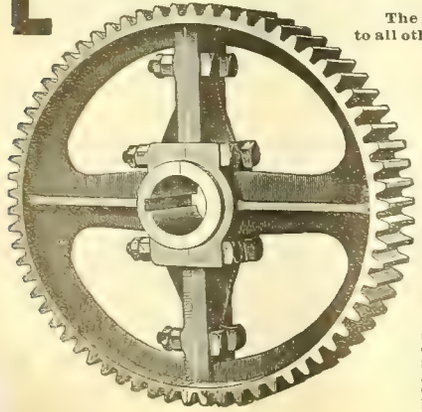

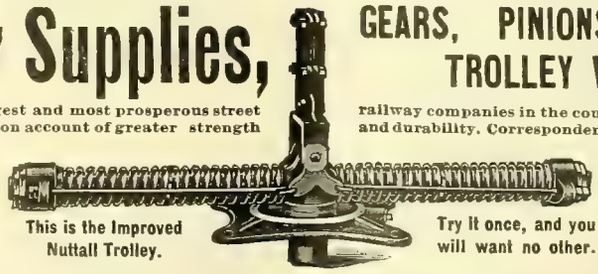

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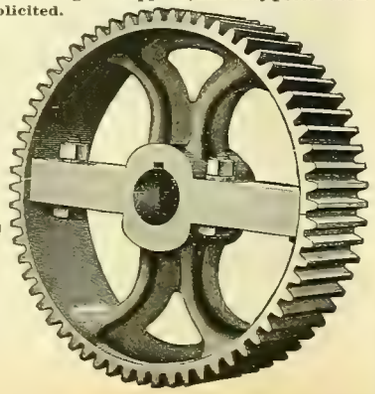

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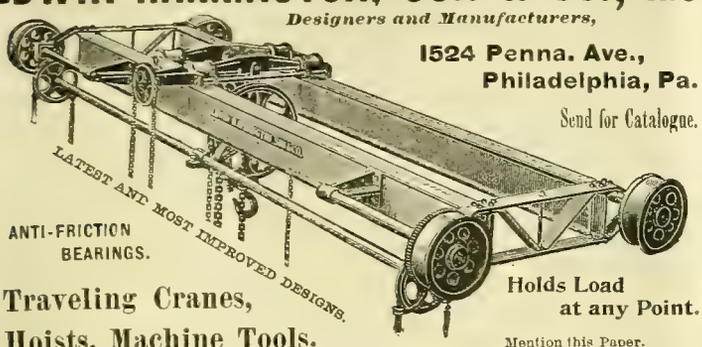


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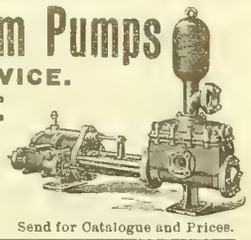

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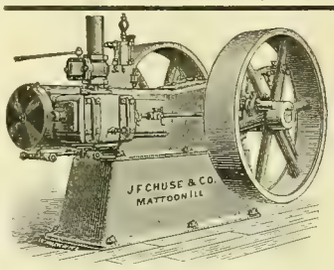


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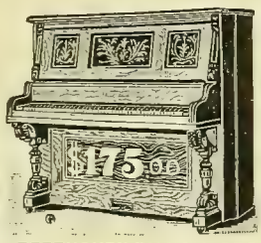

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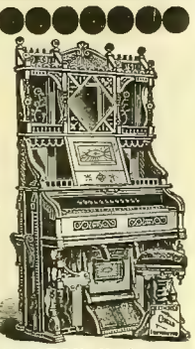

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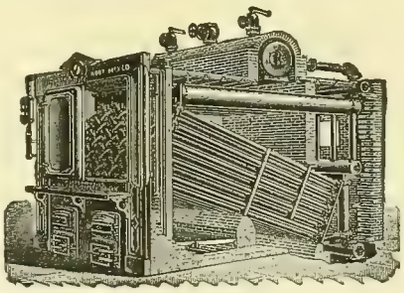

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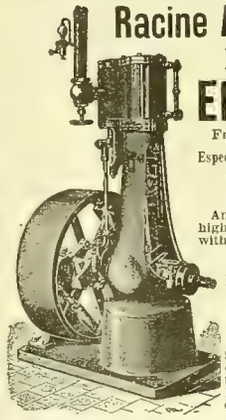

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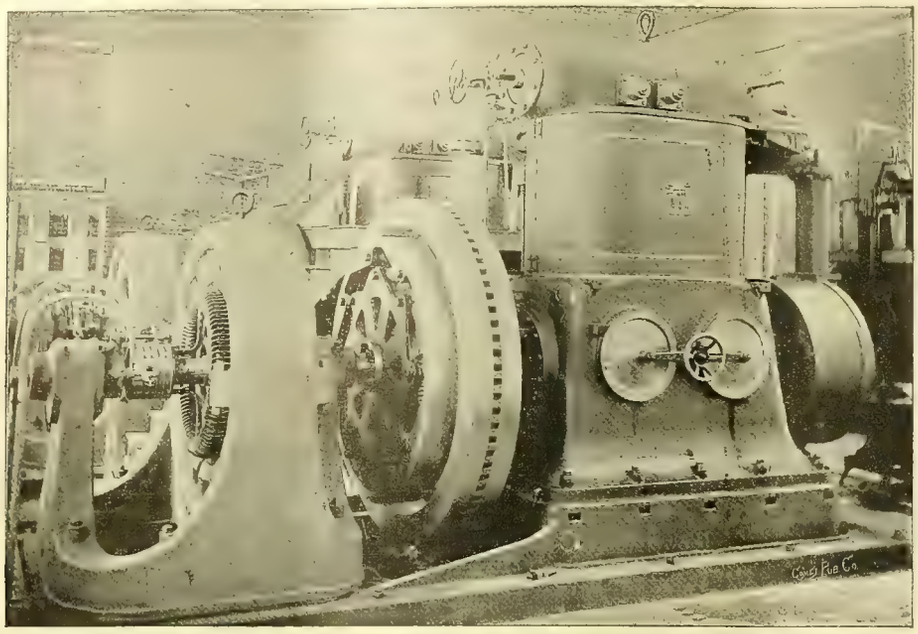

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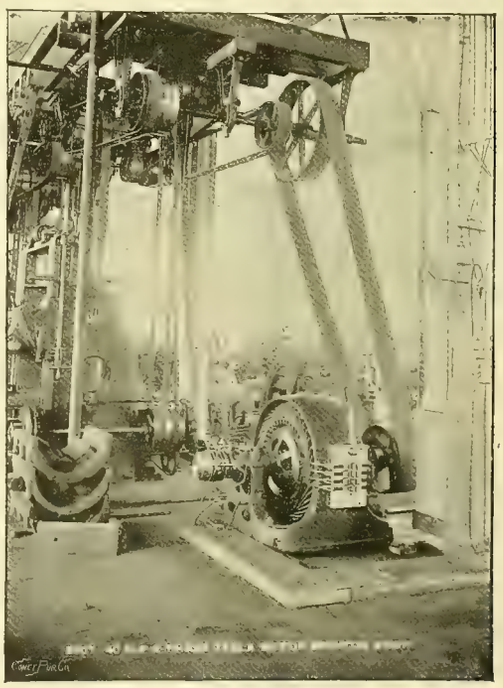

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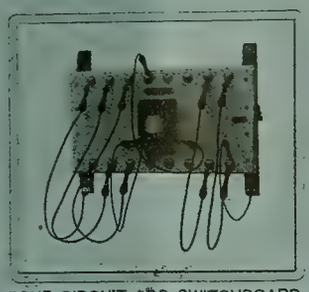

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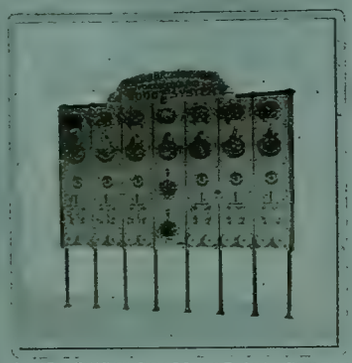

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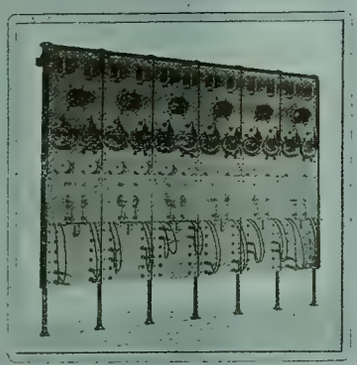

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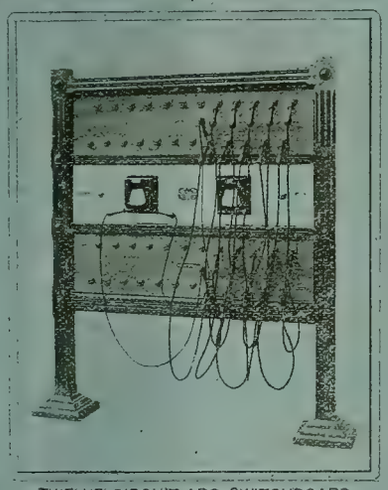
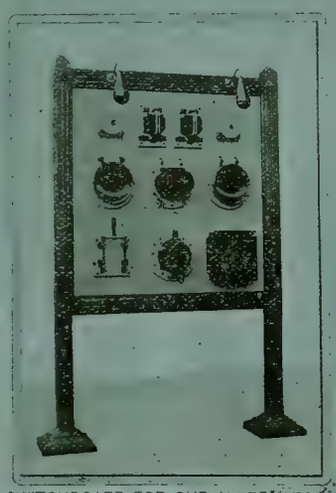


TWELVE CIRCUIT ARC SWITCHBOARD.



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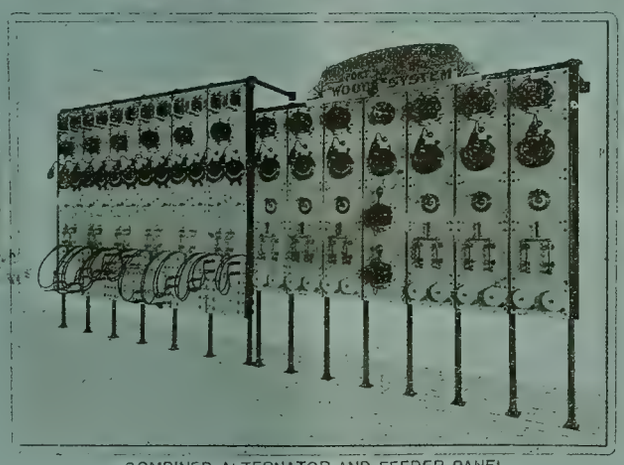

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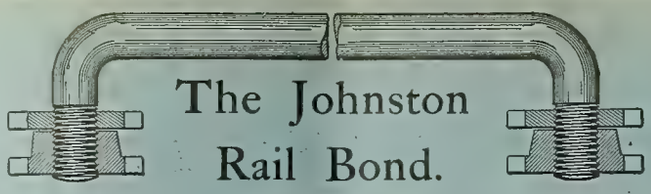

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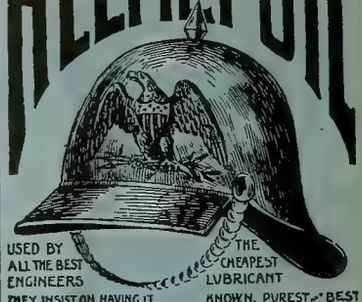

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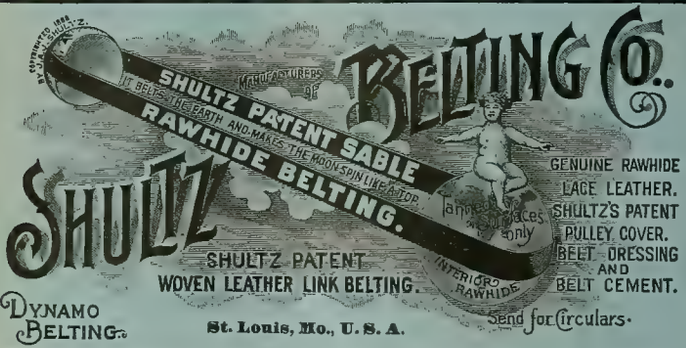


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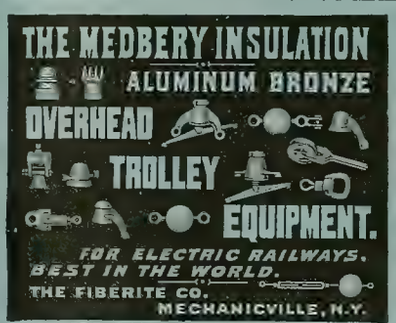


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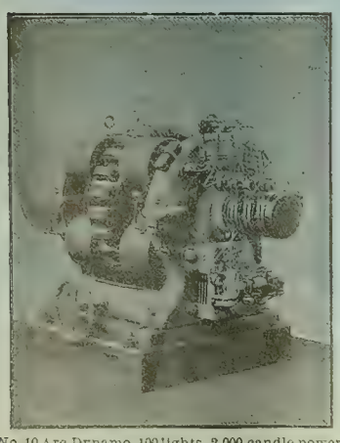

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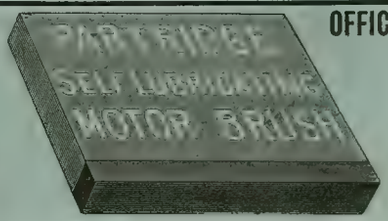


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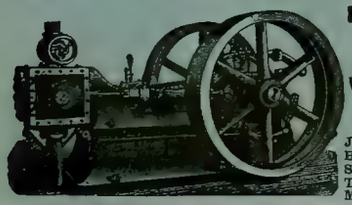

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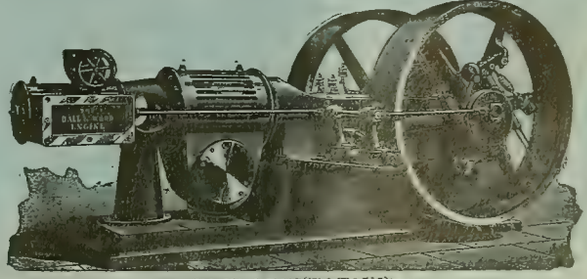

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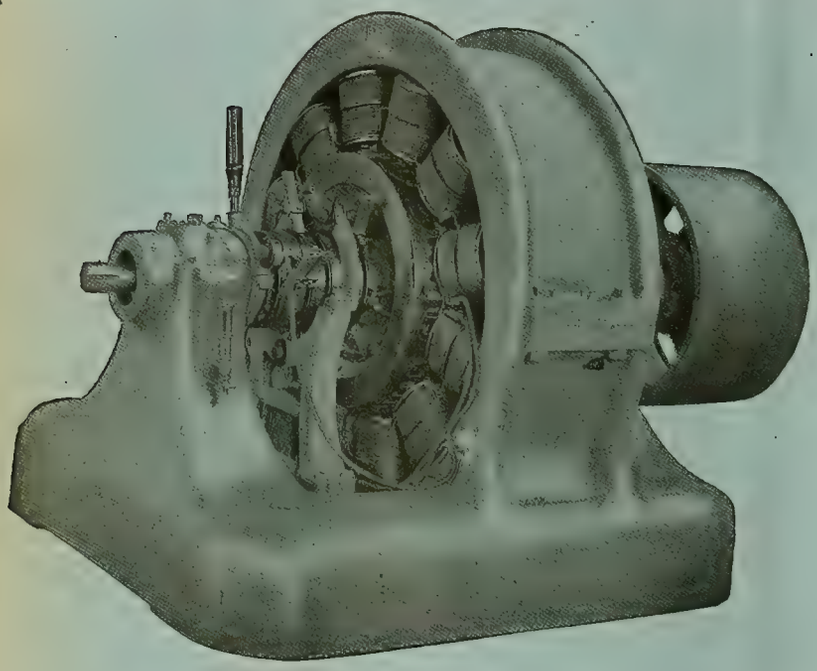

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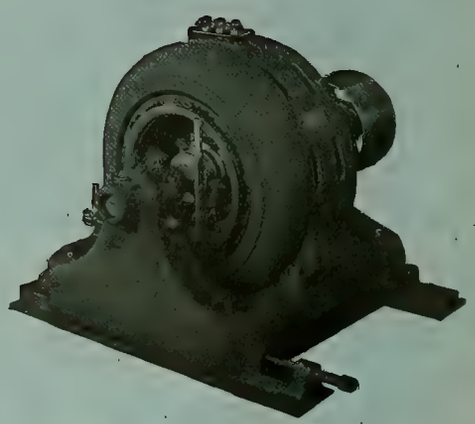

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Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Louisville Elec. Wks
Metropolitan Electric Co.
Mianus Electric Co.
Morris & MacCurdy.
Partrick & Carter Co.
Perkins El. Switch Mfg. Co.
Platt, O. S.
Queen & Co Inc.
Sioux City Brass Works.
S. K. C. Specialty Co.
Solar Electric Co.
Standard Tel. & Elec. Co.
Thayer Electric Co.
Viaduct Co.

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Edwards, W. S. Mfg. Co.
Hemingray Glass Co.

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Dixon Crucible Co., Jos.

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Fiberite Co., The.
Newton Rubber Wks.

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Andrae & Sons, J.
Brixey, W. R.
Brodie Electric Co.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Central Electric Co.
Chicago Ins. Wire Co.
Crocker-Wheeler Elec. Co.
Cutter Elec. & Mfg. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Empire China Works.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Hart & Hegeman Mfg. Co.
Hemingray Glass Co.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Little, F. P. Elec. C. & S. Co.
Louisville Elec. Wks.
Munsell & Co., Eugene.
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Newton Rubber Wks.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Platt, O. S.
Simplex Electrical Co.
Standard Paint Co.
Standard Underground C.Co.
Viaduct Co.

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Bunnell & Co., J. H.
Central Electric Co.
Chicago Ins. Wire Co.
Eastern Electric Cable Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
General Electric Co.
Independent Electric Co.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
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Phillips Insulated Wire Co.
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Columbia Inc. Lamp Co.
Electric Appliance Co.
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Partrick & Carter Co.
United Elec. Imp. Co.
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Diamond Electric Co.
Electric Appliance Co.
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Mianus Electric Co.
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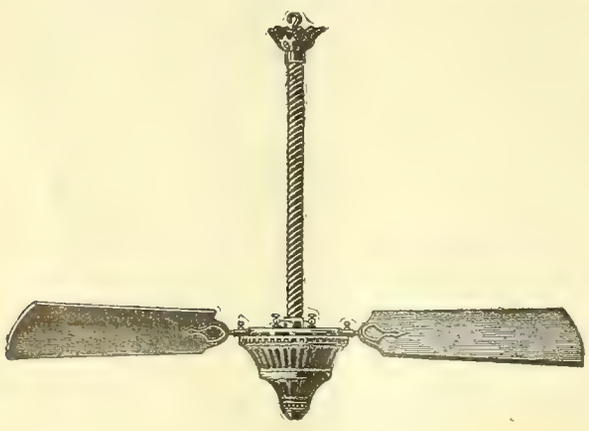

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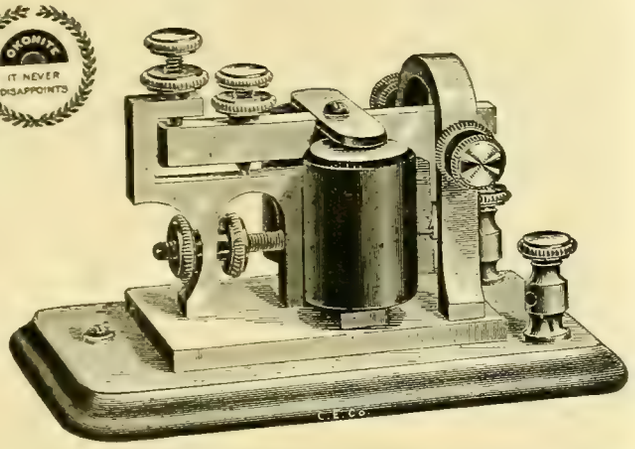

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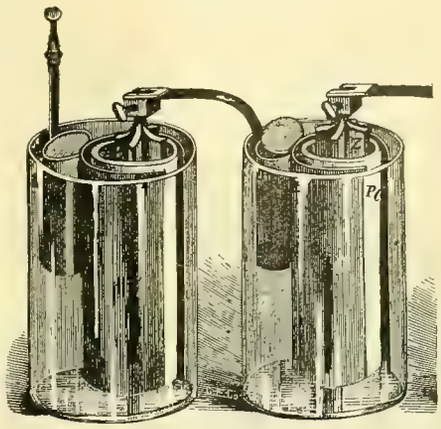

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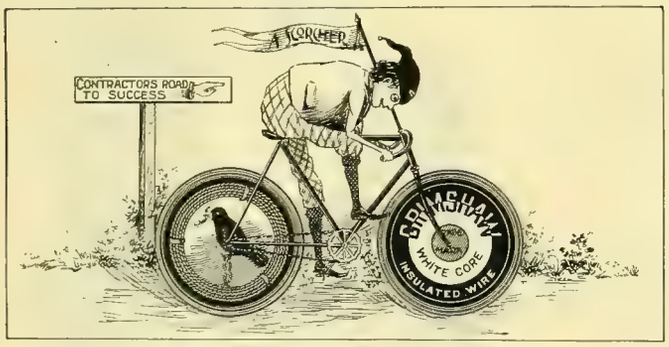


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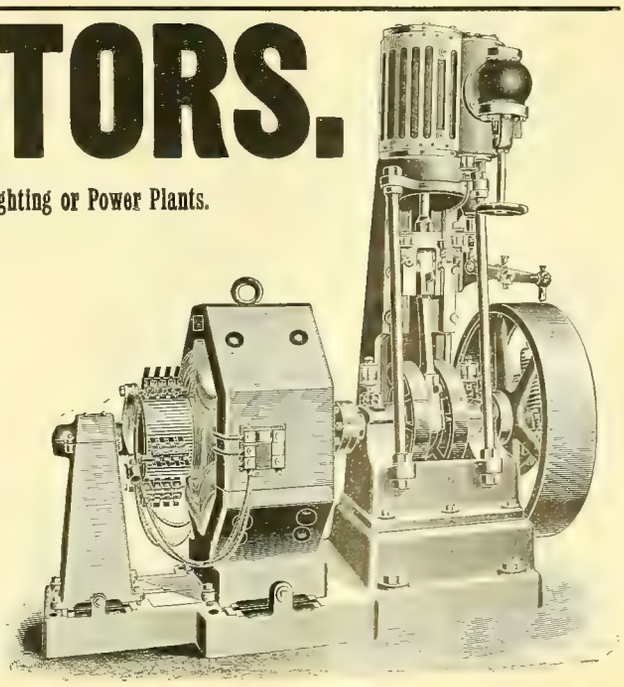

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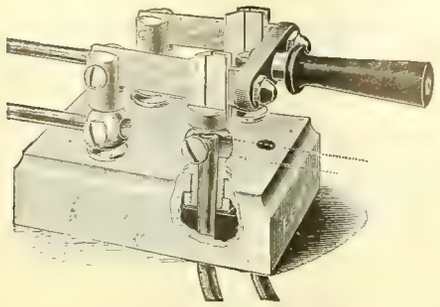
ST. LOUIS, Western Electrical Supply Co.
KANSAS CITY, W. T. Osborn.

# E. E. & S. BABY.



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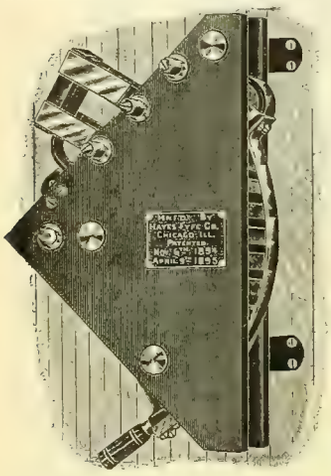

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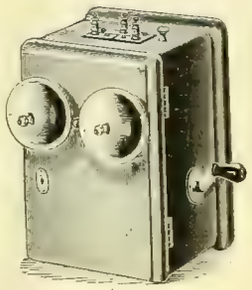

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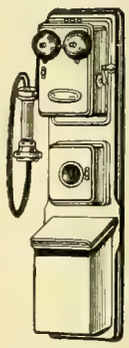

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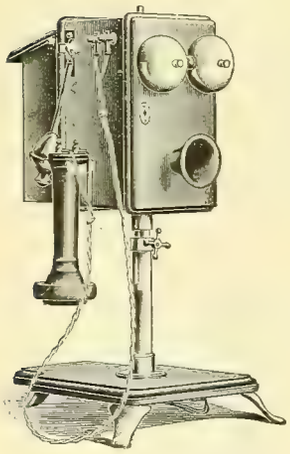
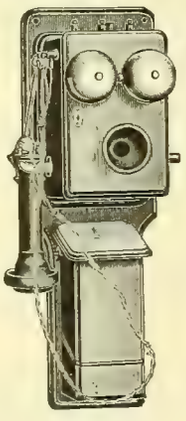
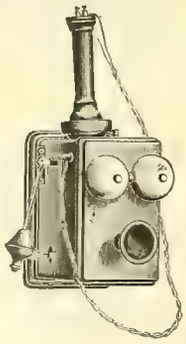
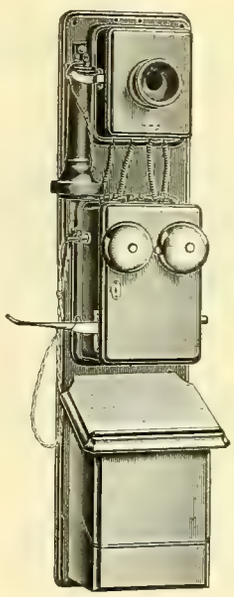
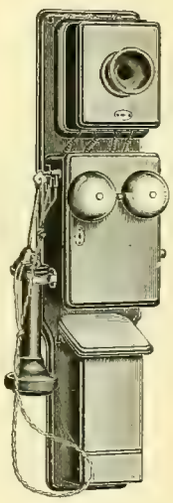


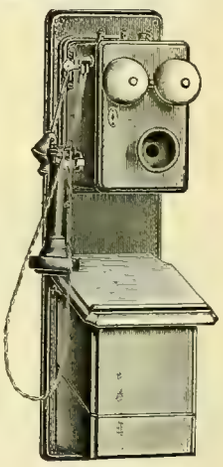




Patented
May 30, 1893.
Dec. 25, 1894.
Jan. 1, 1895.







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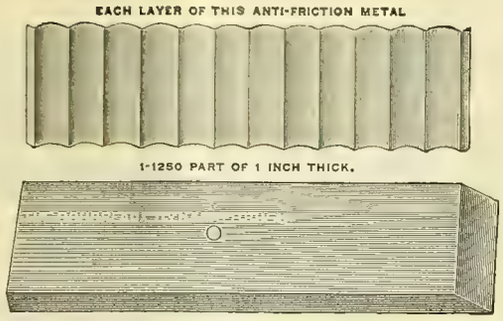


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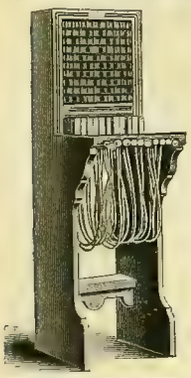

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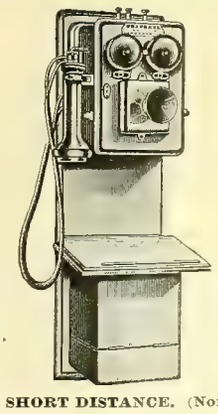

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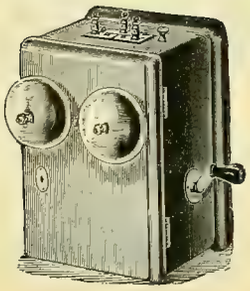
FOR ALL PURPOSES, AT THE LOWEST PRICES.
SEND FOR CATALOGUE.

**MISSOURI TELEPHONE MFG. CO.,** 109 N. 11th Street, ST. LOUIS, MO.



## MAGNETO BELLS

AND

Standard Goods. No Infringements. **TELEPHONES.** Get Our Prices Before Purchasing Elsewhere.

**E. & F. GILLETTE,**
BAYPORT, CONN.

# INCANDESCENT LAMPS.

WE MANUFACTURE THE "GLOBE." LIFE AND EFFICIENCY GUARANTEED.

New Process of Exhaustion by Mechanical Vacuum Pump. Absolutely Dry Vacuum. Samples and Prices Furnished on Application. Correspondence Solicited.

## GLOBE ELECTRIC LIGHT CO., 6 Clifton St., ROXBURY, MASS.

AGENTS WANTED. WRITE US.

## HELIOS ELECTRIC COMPANY,

Factory and Offices,

1310 Filbert Street, Philadelphia, Pa.

*We have no Stock nor Old Style Lamps that we must get rid of at any price—no junk.*

### THE HELIOS LAMPS

Are the latest patterns and newest type. Our Lamps are much in advance of any lamp now on the market, because they are New and of Latest Designs.

Our ALTERNATING LAMPS have Reflector Plates. Our DIRECT CURRENT Lamps do not see-saw. Our Focusing Lamps, both Direct and Alternating, are especially adapted for photo-engraving and stereopticon work.

Anchor Electric Co., New England Agents, Boston, Mass.
Central Electric Co., Western Agents, Chicago.
Moore & Baylis, Agents for Western New York, Buffalo, N. Y.,
Globe Electrical Supply & Construction Co., New York City Agents, Vandam and Greenwich Streets, New York.
Mountain Electric Co., Agents for Colorado, Utah, Wyoming and New Mexico, Denver, Col.
Machinery Supply Co., Agents for Southern California and Arizona, Los Angeles, Cal.
W. T. M. Mottram, Agent for Texas, Dallas, Tex.
Canadian General Electric Co., Canadian Agents, Toronto, Canada.
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## THE UPTON ARC LAMP

For All Circuits.

### The Cheapest to Buy, Use and Maintain.

| | |
|---|---|
| Direct current lamps, constant potential, with globe and resistance, to burn 8, 11, 14 hours, | $12.00 |
| Alternating current lamps and globe, | 14.00 |
| Series current lamps and globe, | 14.00 |

## Standard Thermometer Co.,

PEABODY, MASS.

The Original Manufacturers of the

*SIMPLEX, WARD and KNIGHT LAMPS.*

CHARLES A. BRAMHALL, Selling Agent, 39 Cortlandt Street, NEW YORK.

MOULDED MICA TROLLEY LINE INSULATORS.

### FEED WIRE INSULATORS.

No. 900. No. 902. No. 905. No. 904.

PHILADELPHIA BREAK.

STRAIGHT UNDER-RUN.

Send for Price List of

### INSULATING MATERIALS.

H. W. Johns Mfg. Co.,

240-242 Randolph St., Chicago.

NEW YORK. PHILADELPHIA. BOSTON.

VULCABESTON REPAIR PARTS FOR CONTROLLER.

## ELECTRICAL TESTING INSTRUMENTS.

We carry a full line of volt and ammeters for all purposes. Write for circulars and prices. Other specialties are Resistance Sets, Condensers, Cable Testing Apparatus, Photometers and Tachometers.

## Queen & Co., Inc.

J. G. GRAY, Assignee, 1010 Chestnut St., PHILADELPHIA, PA.

NEW YORK OFFICE, 116 Fulton Street.

## FIVE GOOD BOOKS.

NEW DYNAMO TENDERS' HAND-BOOK.
INCANDESCENT WIRING HAND-BOOK.
BELL HANGERS' HAND-BOOK.
ELECTRIC TRANSMISSION HAND-BOOK.
TELEPHONE HAND-BOOK.

ELECTRICIAN PUBLISHING CO., 6 Lakeside Bldg., Chicago, Ill.

## ONE DOLLAR EACH.

## The PIONEER FIRM - F. Hardtmuth & Co., Vienna, Austria - The PIONEER FIRM.

*THE ONLY MANUFACTURERS OF*

## "The Celebrated Austrian Cored Carbons."

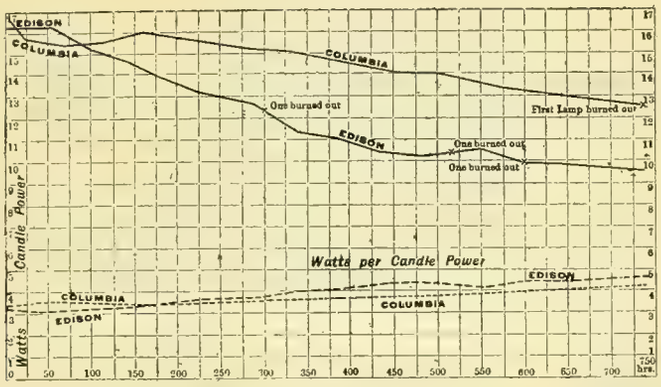
American Branch Office, 60 Liberty St., New York.
Beware of Impostors Claiming our Make.

Send for Reduced Price Lists or Samples,
Alternating or Direct Cored Carbons One Price.

Special Quotations for Export Trade.
Leading Supply Houses Carry Our Goods.

# THE TEST

**Below demonstrates that if Edison lamps are worth 15 cents, Columbia Lamps are worth 45 cents. The present selling price of Columbia Lamps is 20 cents, therefore the present selling price of Edison lamps should be 6 2-3 cents. At the relative difference in price, does it pay to use the cheaper lamp?**




**COMPARATIVE TESTS OF COLUMBIA AND NEW TYPE EDISON LAMPS.**
**NUMBER OF LAMPS STARTED: COLUMBIA, 4; ALL BURNING AFTER 730 HOURS.**
**EDISON, 5; ONLY TWO BURNING AFTER 600 HOURS.**

This test is respectfully referred to "the largest user of incandescent lamps in this country," who recently stated "that the new type Edison lamp equals or surpasses, as to life, sustained candle power and all other features, any lamp burned at the same economy."

Attention is invited to the rapid diminution in candle-power of the Edison lamp and the corresponding increase in watts consumed. After 175 hours, where the number of watts consumed by both lamps was the same, the Edison yields 14 candles in illumination, the Columbia 16. After 300 hours' test an Edison lamp burns out and the remaining Edison lamps give but 12 1-2 candles, while the Columbia lamps give 15 1-4 candles. At 500 hours the difference in favor of the Columbia is as 14 is to 10 1-3, with a saving of nearly one watt per candle power in economy. At 530 hours, and again at 600 hours, an Edison lamp burns out, but not until after 736 hours have passed does the *first* of the Columbia lamps burn out. The candle-power then is: Edison, 9 3 4, to Columbia, 12 3-4, with a saving of .5 watts per candle-power in favor of the Columbia.

That "every other user of Edison lamps (does not) concur" in the statement of the largest user, is best shown by the orders for Columbia lamps received from Edison stations.

If the Columbia lamp is dead and should be thrown out at 750 hours, the Edison lamp is dead and should be discarded at 250 hours. Therefore, it would require three Edison lamps to equal one Columbia lamp. The price of Columbia lamps is 20 cents each, therefore, the price of Edison lamps should be 6 2-3 cents each Lamps carried in stock at branch offices.

---

# The Columbia Incandescent Lamp Co.,

## Office and Works: 1910-1912-1914 Olive St., St. Louis, Mo.

**Branch Offices:**

**CHICAGO OFFICE,** 1236 Monadnock Bldg.
**NEW YORK OFFICE,** 1103 Havemeyer Bldg.
**BOSTON OFFICE,** 620 Atlantic Ave.
**SAN FRANCISCO,** Paul Seiler Elec'l Works.

SAY,

# DO YOU USE THE GARTON ARRESTERS?

IF NOT,

You don't know that feeling of security that comes to all that have a full equipment.

"Safe in the storm that may gather,
Tho' the blue juice may come thick and fast;
Wild and infernal the weather,
The Garton's protect till the last."

**NO INDUCTIVE RESISTANCE. NO PIVOTS OR HINGES.**
**NO FUSES TO BLOW. REQUIRE NO ATTENTION. ARE ALWAYS READY.**

Don't try to get through the balance of the season without them. They don't cost as much as armatures, and will last you an indefinite time. Write to-day.

## GARTON-DANIELS ELECTRIC CO.,

KEOKUK, IOWA, U. S. A.

N. B. OUR PRICES ARE RIGHT.

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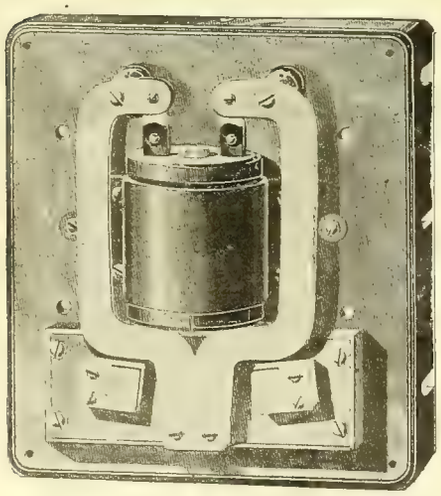
# SINCE MARCH 1st

# Our New (Model 1895) Electric Light and Power Controllers



HAVE BEEN ADOPTED BY CENTRAL STATIONS OPERATING

**5,000** ARC LAMPS AND **60,000** INCANDESCENTS.

They are the Only System which will Cut $\frac{On}{Out}$ your Motors, Arc Lights, Converters, Transformers, from your Central Station.

OUR GENERAL WESTERN AGENTS ARE

## WALLACE ELECTRIC CO., 305 DEARBORN ST., CHICAGO.

## ELECTRIC SELECTOR & SIGNAL CO., 45 Broadway, New York.

# C. E. M. JACK-KNIFE SWITCHES.

We carry the

## LARGEST STOCK

Of Jack-Knife Switches

## IN CHICAGO

And are making the

## LOWEST PRICES

That have ever been quoted on a

## FIRST-CLASS ARTICLE

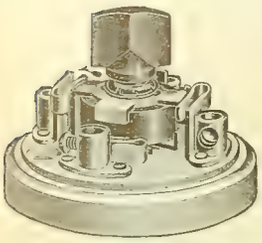
In this line.

Send for our special list.

**ELECTRIC APPLIANCE COMPANY,** Electrical Supplies, CHICAGO.

# HART SNAP SWITCHES!

STANDARD SWITCHES, 5 and 10 ampere S. P.
10 amp. 3 and 4-way, 10, 15, 30 and 50 amp. D. P.



## FLUSH SWITCHES

Of any of the above sizes, either on single plates or with any number of switches upon one plate.

*Cut illustrates 4-way or commutation switch, controls a light or group of lights from any desired number of points.*

**SEND FOR CATALOGUE.**

**THE HART & HEGEMAN MFG. COMPANY,**
**Hartford, Conn.**

**The Brady Mast Arms.**

T. H. Brady, New Britain, Conn., U. S. A.,

Manufacturer of Mast Arms, Pole and Swinging Hoods, House Brackets and other Specialties for Construction Work. — *Catalogues and Prices furnished on application.*

*can be of use to you*

TELEPHONES SENT ON TRIAL.
UNIVERSAL TELEPHONE CO.
INDIANAPOLIS, IND.

## Making History

.....was what we were doing when we brought out the new Standard arc lamp. We admit that other arc lamps may be suitable for Noah's ark, but you and I desire only the latest, the best; for we are keeping pace with the onward march through the opening doors of the twentieth century and have no time to waste on antiquated, crude and complicated mechanisms. It's simplicity, efficiency, perfection, that talk to-day. Cost of maintenance is a more powerful factor with the shrewd buyer than low first cost. Our book is mailed free. Tells the whole story.

STANDARD ELECTRIC COMPANY,
205 La Salle St., cor. Adams, Chicago.

SEND FOR SAMPLES AND PRICES OF

**SAMSON SPOT CORD**

For Arc Light and Trolley Cord.

**SAMSON CORDAGE WORKS, - BOSTON, MASS.**

# Public Telephone Co.,

This system does not infringe the patents of the Bell Telephone or Western Electric Co. We build exchanges complete for local companies, or will install and operate exchanges ourselves at a low monthly rental. We keep in stock Blake transmitters and all kinds of supplies.

**MANUFACTURERS OF THE SHAVER LONG DISTANCE PULVERIZED CARBON**

**TELEPHONE**

**For Exchanges, Etc.**

**Correspondence Solicited.**

**PUBLIC TELEPHONE CO.,**

**Office and Factory:**
**Thames Building, 27 Thames Street.**

NEW YORK.

## P. & B. Armature and Field Coil Varnish.

## P. & B. Insulating Compound.

## P. & B. Insulating Tape.

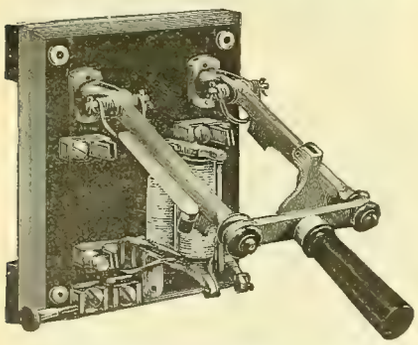
**We are the sole manufacturers of the P. & B. products which have been the STANDARD for ten years.**

**Send for samples and price lists.**

## The Standard Paint Co.,

| CHICAGO: | No. 2 Liberty Street, | LONDON: |
|---|---|---|
| Metropolitan Elec. Co., | NEW YORK. | Robert W. Blackwell, |
| 186-188 Fifth Ave. | | 39 Victoria St., S. W. |

# MOTOR ARMATURES COST MONEY



You can prevent them from burning out by using

## THE BRODIE AUTOMATIC MOTOR-SWITCH.

It combines in one piece of apparatus a double-pole switch, adjustable limit-switch and automatic cut-out, and instantly disconnects the motor whenever it is overloaded and whenever the circuit fails from any cause.

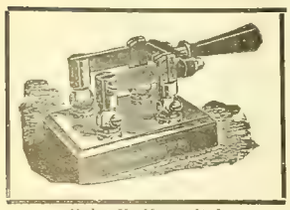
Agents wanted in all sections of the country.

For circulars and prices, address

**THE BRODIE ELECTRIC CO., - Manchester, N. H.**

## BRYANT DOUBLE POLE SWITCHES.

For Moulded and Concealed Work.



Baby Knife Switch.

## Bryant Electric COMPANY,

**Bridgeport, Conn., and Chicago.**

GRIER BROS, Managers, Western Office.

The R. Thomas & Sons Porcelain is good.

# C-S SPECIALTIES.

## C-S Flush Double Push Switch.

Single Pole—Double Pole—Commutation; 3 Wire, 4 Wire.

## C-S Flush Key Switch.

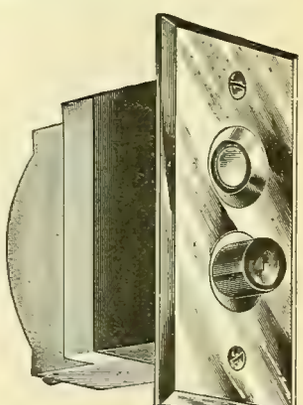
Single Pole—Double Pole—3 Wire.

## C-S Flush Automatic Switch.

Single Pole.

ELECTRICALLY
MECHANICALLY
ARTISTICALLY

**PEERLESS.**



C-S Flush Double Push Switch—Double Pole.

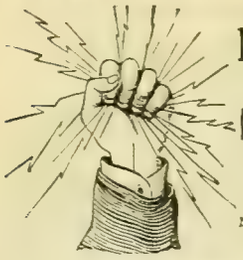
# THE CUTTER ELECTRICAL & MFG. CO.,

***27 So. 11th Street, Philadelphia, Pa., U. S. A.***

EUGENE F. PHILLIPS, Prest. W. A. HATHAWAY, Treas. W. H. SAWYER, Secy

# AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.



BARE AND INSULATED ELECTRIC WIRE,

ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,

Railway Feeder and Trolley Wire,

AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.

CABLES FOR AERIAL AND UNDERGROUND USE.

NEW YORK STORE, P. C. Ackerman, 10 Cortlandt St.
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## No. 11 DOUBLE GROOVE PONY INSULATOR.

**Can be Used for Transposing.**

The points or teats on the lower rim of the petticoat attracts the water on the outer surface of the insulator into drops. The water drops from these points on to the cross-arm, thereby preventing the moisture from creeping up on the inner petticoat, and thence to the pin. Owing to the great success of our Patent Teat Insulator in Telegraph Work, where the efficiency of the Insulator has proven to be more than twice that of the ordinary Insulator, we have concluded to apply the device to all Insulators for Telegraph, Telephone and Street Railway Work.

Standard Screw Glass Insulators,
Floor Insulators, Glass Break Knobs, Battery Jars, Arc Light Globes for all Systems.
Colored Glass Insulators to designate different currents.

**WORK ON SPECIAL DESIGNS A FEATURE.**

Send Model or Drawing and we will furnish estimates.

**HEMINGRAY GLASS CO.,**

Office, Covington, Ky. —ESTABLISHED 1848.— Factories, Muncie, Ind.

THE

# "CLARK" WIRE.

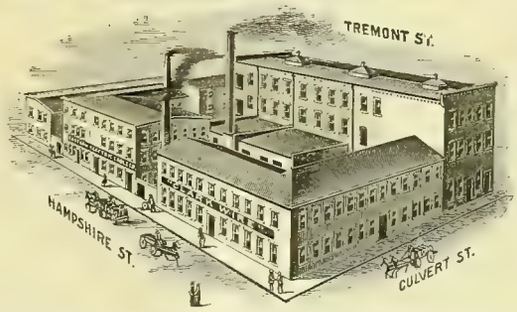
TRADE MARK.

For Switchboard, Railway and Motor use, we make all sizes of Stranded and Flexible Wire and Cables with Clark's Insulation.

The Clark Wire has been before the public and in use for the past nine years, and has met with universal favor. Thousands of miles of this wire have been sold, and are in use throughout the United States and Foreign Countries, and the demand for it is constantly increasing, because it always gives perfect satisfaction.

**BRANCH OFFICE:**

**1649, 1650, 1651 MONADNOCK BLDG.,**
**CHICAGO, ILLINOIS.**




**In a Letter from the Inspector of the Boston Fire Underwriters' Union, he states: "A Thoroughly Reliable and Desirable Wire in every respect."**

The Rubber used in insulating our Wires and Cables is especially chemically prepared, and will not deteriorate, oxidize or crack, and will remain flexible in extreme cold weather, and is not affected by heat.

We guarantee our Insulation wherever used, Aerial, Underground or Submarine, and our net prices are as low, if not lower, than any other first-class Insulated Wire.

We shall be pleased to mail Catalogues with Terms and Discounts for Quantities.

**EASTERN ELECTRIC CABLE CO.,**

61 and 63 Hampshire St., Boston, Mass.

HENRY A. CLARK, Treas. and Gen'l Mgr. HERBERT H. EUSTIS, Prest. and Electrician.

The Best on the market.
*Morris & MacCurdy,*
Indianapolis, Ind.

**BINDERS**
For the WESTERN ELECTRICIAN,
—$1.00.—

# GRAPHITE SPECIALTIES

**FOR ELECTRICAL USES:**

**Graphite Rods of Various Lengths, from 1-5 Ohm to 100 Ohms Resistance to the inch. Graphite Boxes and Crucibles, Resisting Heats of 4,000 Degrees. Inquiries Gladly Answered.**

**JOS. DIXON CRUCIBLE CO., Jersey City, N. J.**

## Clark Electric Specialty Mfg. Co.,

28 S. Washington Ave., Minneapolis, Minn.,
MANUFACTURERS OF
**Switch Boards, Battery Boxes, Push Buttons, Rosette Mouldings, Etc.**
Correspondence solicited.

## SPEAKING TUBES AND WHISTLES.

Oral, Electric, Pneumatic and Mechanical

**ANNUNCIATORS AND BELLS.**

Full Line Always in Stock.

**W. R. OSTRANDER & CO.,**
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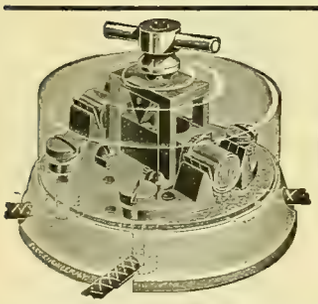
Factory, 1461 and 1463 DeKalb Ave., Brooklyn, N. Y.
Send for NEW CATALOGUE. Out August 1st.

**Storage Batteries**
FOR ALL PURPOSES.
Bradbury-Stone Electric Storage Co.,
LOWELL, MASS



# MANY SWITCHES

HAVE COME AND GONE, BUT THE

## NEW ENGLAND SWITCH

IS STILL THE

**PEER OF ALL.**

TRY THEM AND WONDER WHY YOU EVER USED ANY OTHER.

**O. S. PLATT, - 88-102 Cannon St., Bridgeport, Conn.**

# IRON ARMORED
# INSULATING CONDUITS.

Two Wires in a Single Tube, the Standard Method of Electric Wiring.

## INTERIOR CONDUIT & INSULATION CO.,

**General Offices and Works: 527 W. 34th St., New York.**

Edwd. H. Johnson, Prest. E. W. Little, Vice-Prest. and Gen. Mgr. Chas. P. Geddes, Sec'y and Treas.

**IF** you are anxious to secure the latest electrical books, **YOU** should write to the Electrician Publishing Co., Chicago. You **CAN'T** procure too many reliable, readable books to **READ.**

# ELECTRICAL SUPPLIES.

## WESTERN ELECTRIC COMPANY,

CHICAGO. NEW YORK.

AGENCIES:

ELECTRIC APPLIANCE CO. CHICAGO, ILL.
PETTINGELL-ANDREWS CO., BOSTON, MASS.
ELECTRICAL ENGINEERING CO., MINNEAPOLIS, MINN.
ST. LOUIS ELECT'L SUPPLY CO., ST. LOUIS, MO.
BRADFORD BELTING CO., CINCINNATI, OHIO.

# Phillips Insulated Wire Co.,

NEW YORK OFFICE: 39 and 41 Cortlandt St.

FACTORY: Pawtucket, R. I.

## WANTED.

A first class winder; must be absolutely reliable. Only man with extensive experience with all classes of windings need apply.

Address C. & B. ELECTRIC CO.,
St. Paul, Minn.

## WANTED.

25 or 30 H. P. 500 volt Motor in first-class order; cheap for cash.

WARREN SPR'NGER,
207 S. Canal St., Chicago.

## WANTED.

Situation as superintendent or electrician of electric light or power plant. Seven years' experience in constructing and operating electric light plants; four years in street railway plant. Best of references.

Address "N. F.,"
Care of WESTERN ELECTRICIAN.

## WANTED.

Situation as Superintendent, Electrician or Steam Engineer of an electric light or street railway. Seven years practical experience operating and constructing light and power systems. One year as superintendent of a large light and power plant. Fifteen years constructing and operating steam apparatus. Machinist by trade; experience with water power.

"C. H." care WESTERN ELECTRICIAN.

## POSITION WANTED.

As electrician or armature winder. Have had several years' experience; can equip, repair or wind arc, incandescent generators, direct or alternate current machines, motors, wiring of cars, inside and outside wiring. Competent to take charge. Best of references. Moderate salary.

Address "winder,"
care of WESTERN ELECTRICIAN.

## FOR SALE.

5 Bergman 10 amp. Alternating Current Arc Lamps.
5 Knight 10 amp. " " " "
1 Helios with Spencer Economy Coil.

Above lamps are in first-class condition, used but a short time and will sell cheap.

O. I. Newton's Sons Co.,
SPARTA, WIS.

## SEALED PROPOSALS.

Sealed bids will be received at the office of the City Clerk of the City of Ann Arbor, until 12 o'clock, Thursday, August 1, 1895, for lighting the streets, alleys and public places of said city, for a term of five years beginning the 31st day of December, A. D. 1895, with not less than 96 arc lights of 2,000 candle power and three incandescent lamps of of 65 candle power each, for

265 nights all night,
365 nights all night,
265 nights from twilight to 12:30,
365 nights from twilight to 12:30,

Separate bids for each proposition. The right is reserved to reject any or all bids.

GLEN V. MILLS,
City Clerk.

# Scrap Copper Wire
## WANTED.

It will pay the Electrical Plants to save their Scrap Copper Wire and ship to us in any quantity, at the following prices, f. o. b. Chicago, cash on receipt of same:

| | | |
|---|---|---|
| Bare Copper Trolley Wire | 8¼ | cts. per lb. |
| Ordinary Bare Copper Wire Scrap, | 8 | " " |
| Insulated Copper Wire | 5 to 7 | " " |
| Heavy Red Scrap Brass | 7 | " " |
| Heavy Yellow Scrap Brass | 6 | " " |
| Light Sheet Brass | 3½ | " " |

We receive metals in any quantity and send prompt returns. We also supply the Electrical trade with Cotton Waste, in bales of 100 and 500 lbs., also Babbitt, in lots of 100 lbs. and over, at the very lowest prices. It will pay you to correspond with us. Address

## Swarts Metal Refining Co.,
CHICAGO'S LEADING METAL HOUSE,

Established 1885. Incorporated 1895.
120-122 W. Lake St.
CHICAGO, ILL.

Write for Illustrated Catalogue.

## WE DO INCREASE SALES

By making a specialty of preparing Lists of the latest NAMES and ADDRESSES covering all lines of Trades, Professions or Occupations in any state or territory of the United States or Canada. These lists are in neat manuscript form and are accurate and reliable. Write for Prices, etc.

MERCANTILE TRADE LIST SUPPLY CO.,
601 Times Building, PITTSBURG, PA.

**ROSE POLYTECHNIC INSTITUTE,** Terre Haute, Ind. A School of Engineering. Mechanical, Electrical, Civil Engineering, Chemical courses. Well endowed. Extensive Shops and Foundry. Modernly equipped Laboratories in all departments. Expenses low. Address C. L. MEES, President.

## USE THE BEST!
## Eureka Commutator Compound.

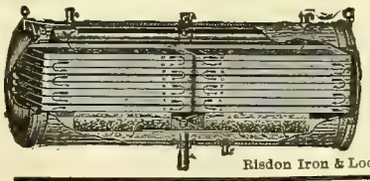
A perfect Compound for Dynamos and Motors. Works on any Commutator with Copper or Carbon Brushes. Send for sample; price 50c per stick.

Edw. R. Tornberg,
SIOUX FALLS, S. D.

Engravers for Western Electrician,

## ILLINOIS ENG. CO.,
ENGRAVERS BY ALL PROCESS.
346-350 DEARBORN ST.,
CHICAGO.

# Stilwell's Patent Live Steam-Feed Water Purifier.



**Removes all Impurities.**

Entirely prevents *scale* in Steam Boilers. Catalogue on application.

The Stilwell-Bierce & Smith-Vaile Co.,
DAYTON, OHIO.

Risdon Iron & Loc'tive W'ks, San Francisco, Cal., Pacific Coast Agt.

## Wisconsin Resorts.

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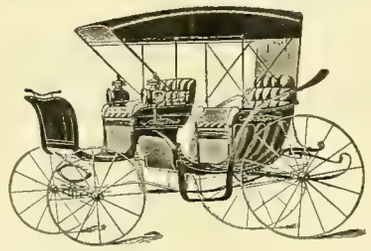

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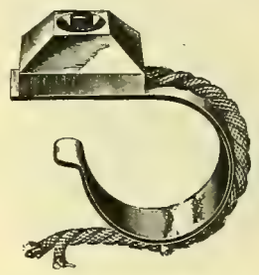

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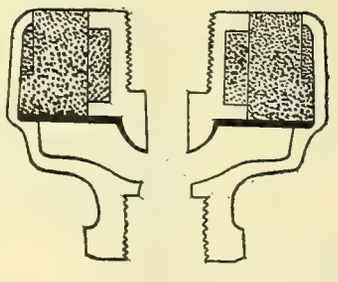

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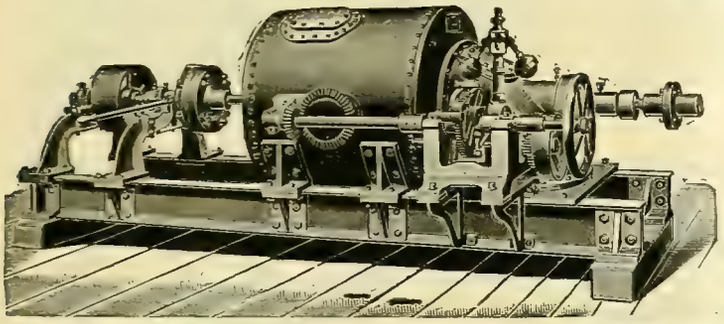

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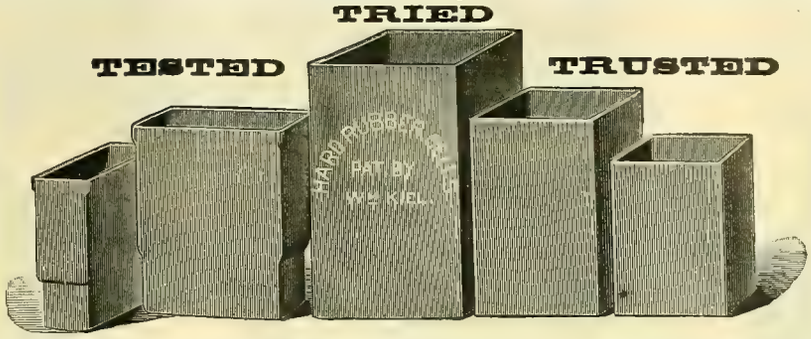


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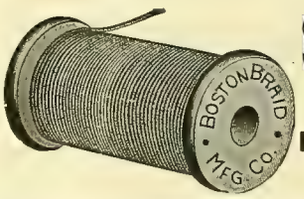


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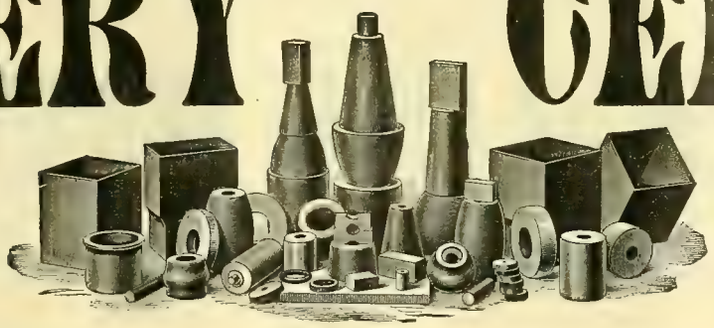

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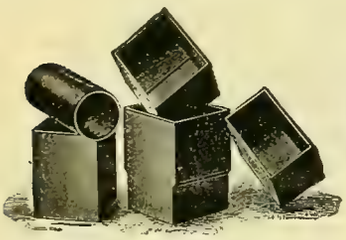

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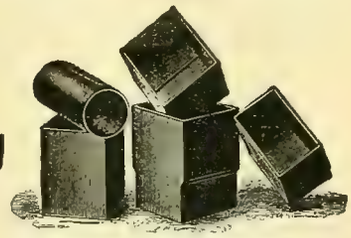

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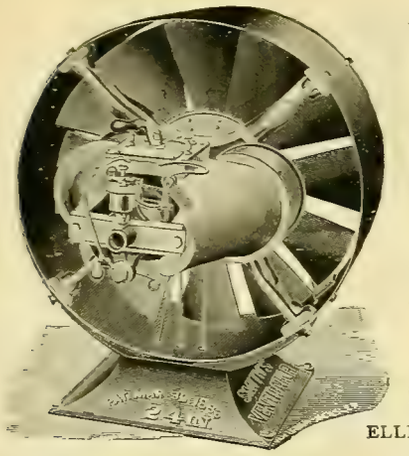

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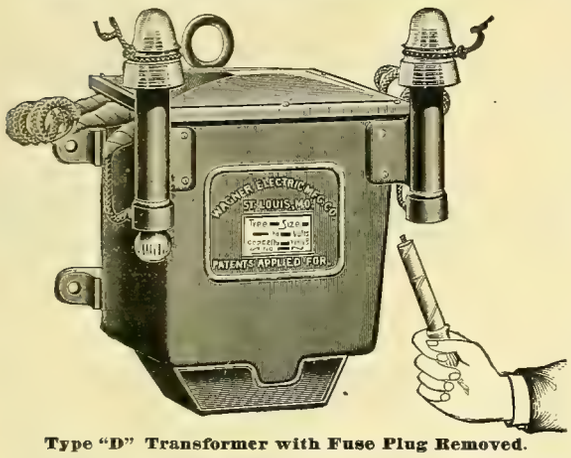


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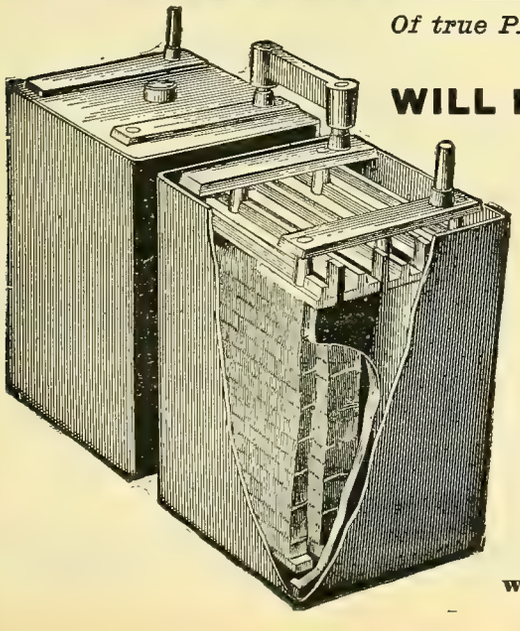

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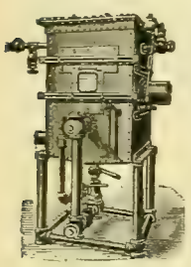

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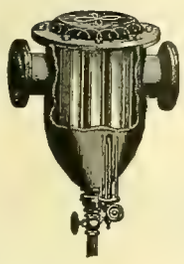

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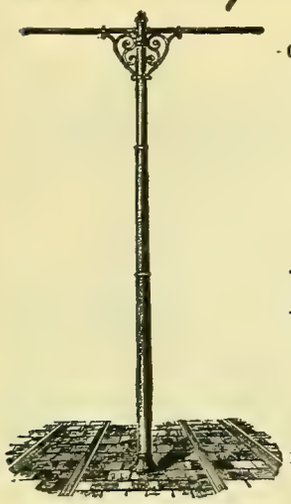

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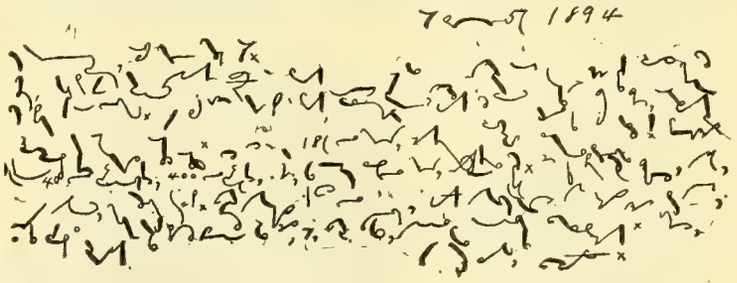

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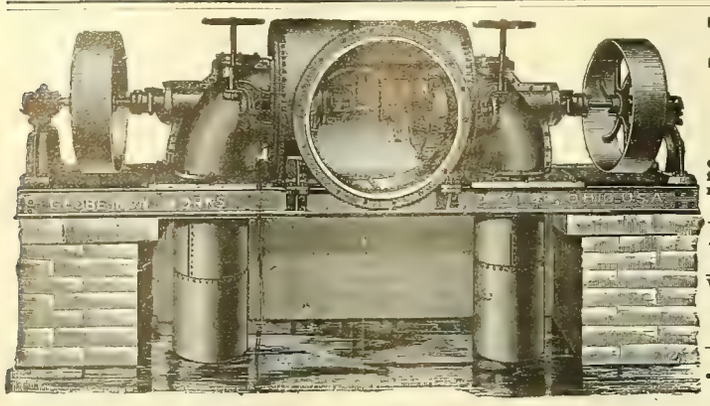

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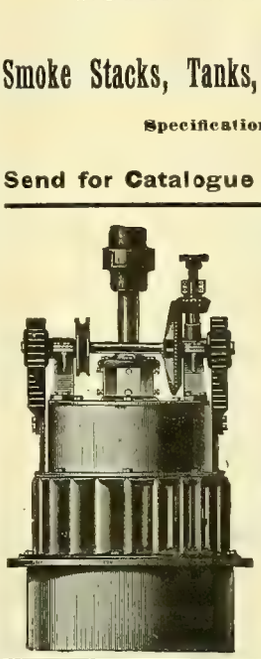

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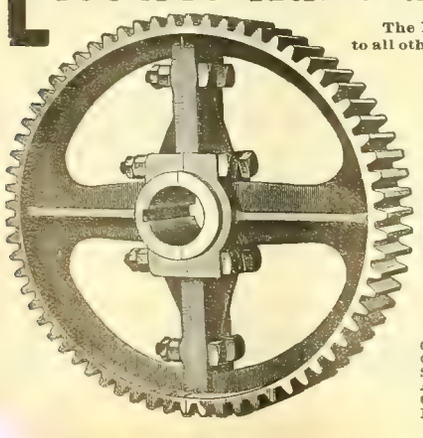

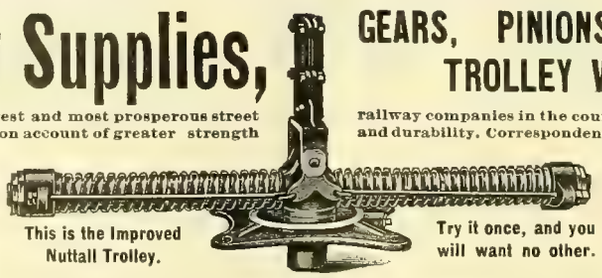

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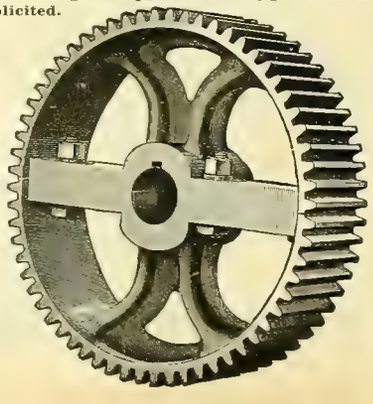

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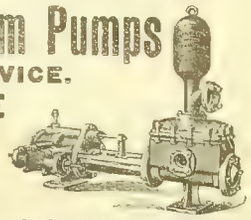

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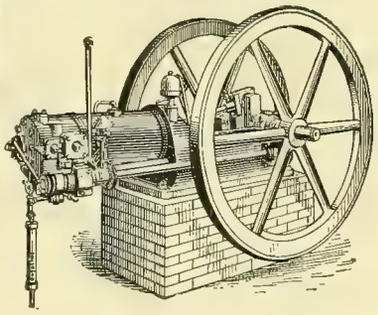

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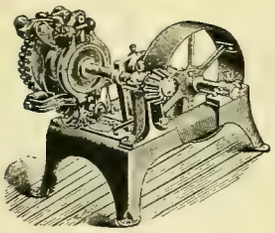

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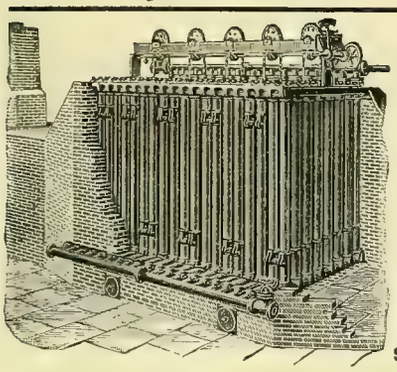

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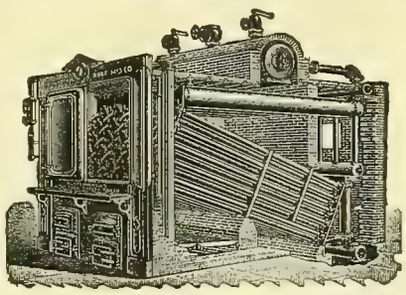

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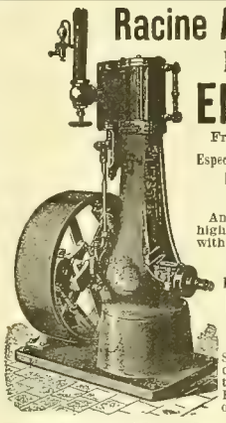

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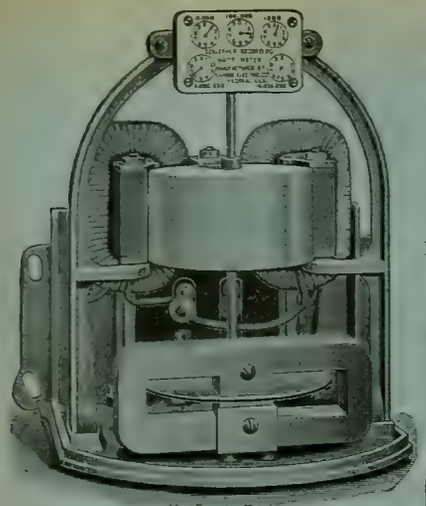

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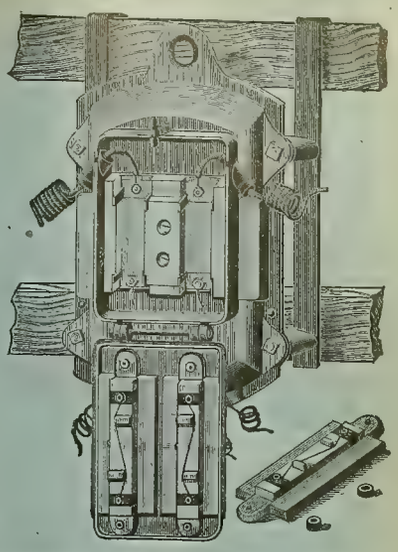

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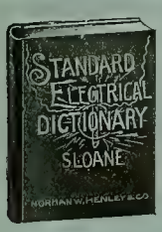


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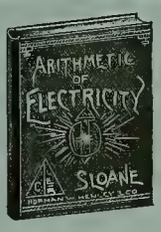


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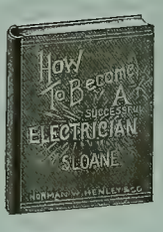


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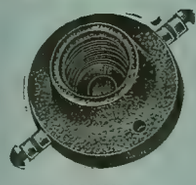

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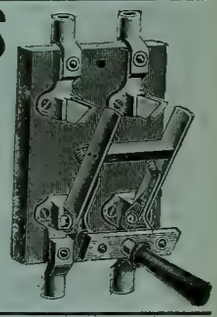

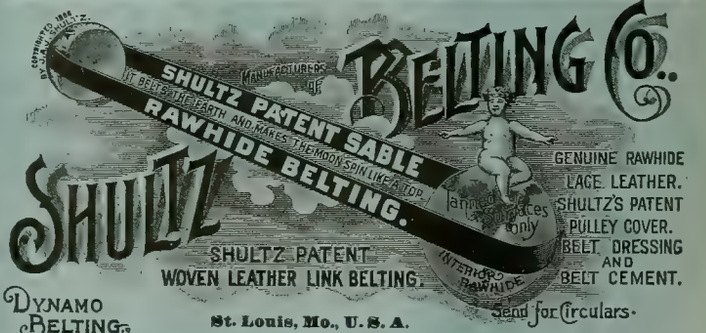


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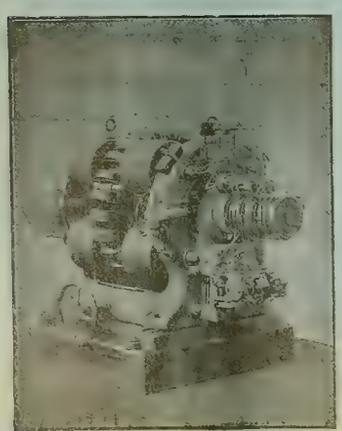

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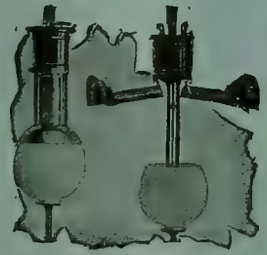

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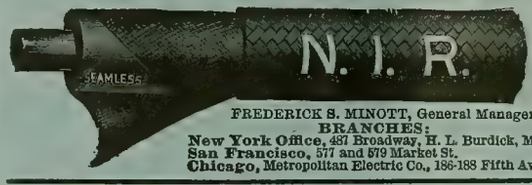


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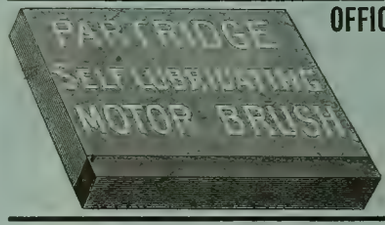


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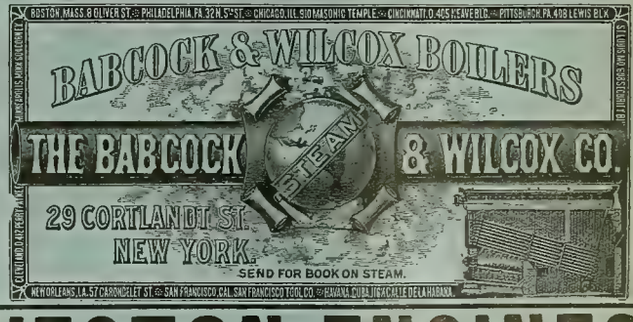


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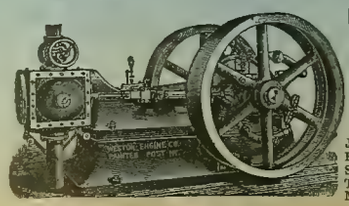

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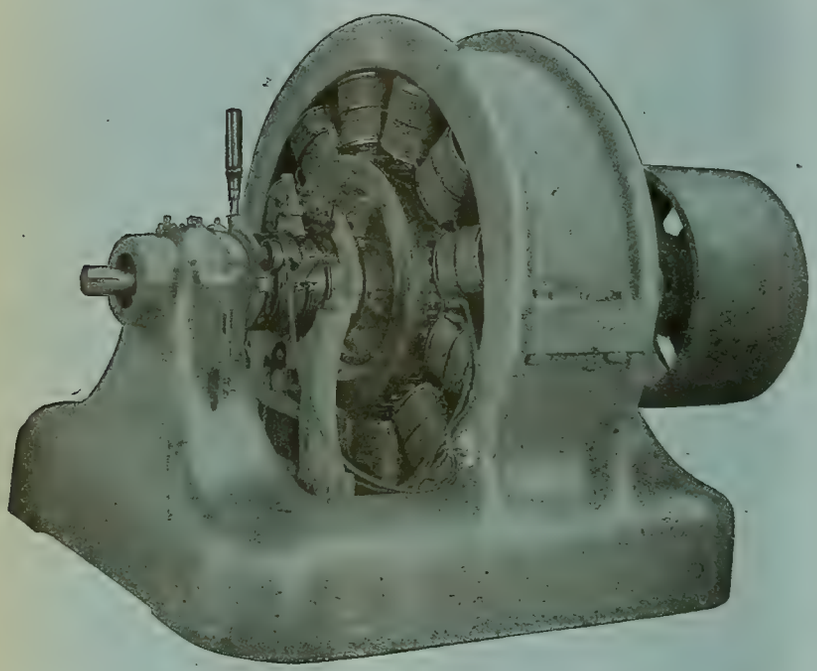

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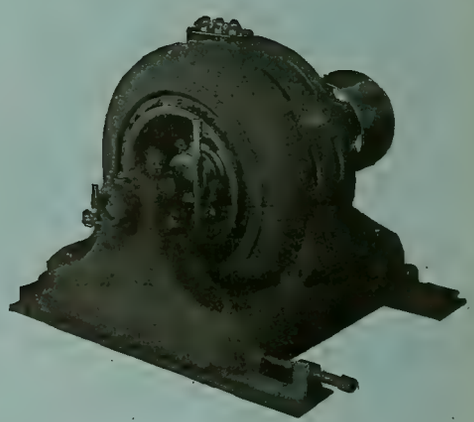

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**Accumulators.**
Bradbury-Stone Elec. S. Co.
Electric-Power Storage Co.
Electric Storage Battery Co.

**Annunciators.**
Central Electric Co.
Chicago Gen'l Fixture Co.
Electric Appliance Co.
Ostrander & Co., W. R.
Partrick & Carter Co.

**Arc Lamps.**
Central Electric Co.
Chicago Gen'l Fixture Co.
Corey, R. B.
Crocker-Wheeler Elec. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Helios Electric Co.
Little, F. P. Elec. C. & S. Co.
Perkins El. Switch Mfg. Co.
Solar Electric Co.
Standard Electric Co.
Standard Thermometer Co.
Waterman, C. H.
Westinghouse El. & Mfg. Co.

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Samson Cordage Wks.

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Boynton Multivolt Batt'y Co.
Bradbury-Stone Elec. S. Co.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Central Electric Co.
Chicago Gen'l Fixture Co.
Edgerton Pottery Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Hemingray Glass Co.
Leclanche Battery Co., The.
Miamisburg Electric Co.
Newton Rubber Wks.
Partrick & Carter Co.
Western Electric Co.

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Andrae & Sons, J.
Central Electric Co.
Electric Appliance Co.
Gillette, E. & F.
Huebel & Manger.
Ostrander & Co., W. R.
Partrick & Carter Co
Western Electric Co.

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Shultz Belting Co.

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Babcock & Wilcox Co., The.
Clonbrock Steam Boiler Co.
Moyes, L. M.
Racine Hardware Co.
Weston Engine Co.

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Electrician Publishing Co.

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Besly & Co., Chas. H.
Phosphor Bronze Sm. Co., Ltd.

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Belknap Motor Co.
Boudreaux Dyn. Brush Co.
Central Electric Co.
Partridge Carbon Co.

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Central Electric Co.
Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

**Cables** (See Insulated Wires.)
**Cables, Electric** (See Insulated Wires), **Copper, Sheet and Bar.**
American Elec. Works.
Brixey, W. R.
Central Electric Co.
Chicago Ins. Wire Co.
Eastern Electric Cable Co.
Elec. Engr. & Supply Co.
Moore, Alfred F.
New York Ins. Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Western Electric Co.

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DeRonde & Co., A.
General Electric Co.
Hardmuth & Co., F.
Partridge Carbon Co.
Reisinger, Hugo.
Wertheim, Ed.
Western Electric Co.

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**Clocks, Watchmen's.**
Southgate & Co., W. B.

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Tornberg, Edw. R.

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Interior Conduit & Ins. Co.

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Interstate Com. El. Const. Co.

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Brush Electric Co.
Bryan, Wm. H.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
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Ft. Wayne Elec. Corporation.
General Electric Co.
Goltz & Sinclair.
Interior Conduit & Ins. Co.
Siemens & Halske Elec. Co.
Standard Electric Co.
United Elec Improvement Co
Walkins, Louis E.
Westinghouse Elec & Mfg. Co.
Western Electric Co.
Woods & Co., C. E.

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Besly & Co., Chas. H.
Miamisburg Electric Co.

**Copper Wire Bought.**
Swarts Metal Refining Co.

**Copper Wires.**
American Electrical Works.
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Brixey, W. R.
Bunnell & Co., J. H.
Central Electric Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.
National India Rubber Co.
Okonite Co. The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Western Electric Co.

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**Cranes.**
Harrington, Son & Co., E.

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Anderson, Albert & J. M.
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Brodie Electric Co.
Central Electric Co.
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Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Nuttal Co., R. D.
Partrick & Carter Co.

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Bryant Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Edison Co.
Chicago Gen'l Fixture Co.
Colgate Co., Geo. L.
Crocker-Wheeler Elec. Co.
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Diamond Electric Co.
Eddy Elec. Mfg. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric Protection Co.
Elec. Selec. & Signal Co.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
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Forsyth & Fisk.
Ft. Wayne Elec. Corporation.
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Huebel & Manger.
Interior Conduit & Ins. Co.
Little, F. P. Elec. C. & S. Co.
Louisville Elec. Wks.
Nuttall Co., R. D.
Partrick & Carter Co.
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Platt, O. S.
Solar Electric Co.
Wagner Elec. Mfg. Co.

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Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Elliott-Lincoln Elec. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
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Roth Bros. & Co.
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Standard Electric Co.
Walker Mfg. Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

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Bryan, Wm. H.
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Goltz & Sinclair.
Thayer Electric Co.
Walkins, Louis E.
Woods & Co., C. E.

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Bunnell & Co., J. H.
Central Electric Co.
Diamond Electric Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Interior Conduit & Ins. Co.
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Platt, O. S.
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General Electric Co.
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Partrick & Carter Co.

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Nuttall Co., R. D.

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Andrae & Sons, J.
Besly & Co., Chas. H.
Brodie Electric Co.
Bryant Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Edison Co.
Chicago Gen'l Fixture Co.
Colgate Co., Geo. L.
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Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric Protection Co.
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Morris & MacCurdy.
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Platt, O. S.
Queen & Co. Inc.
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S. K. C. Specialty Co.
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Thayer Electric Co.

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Dixon Crucible Co., Jos.

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Brixey, W. R.
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Bunnell & Co., J. H.
Butler Hard Rubber Co.
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Chicago Ins. Wire Co.
Crocker-Wheeler Elec. Co.
Cutter Elec. & Mfg. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
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Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Hart & Hegeman Mfg. Co.
Hemingray Glass Co.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Little, F. P. Elec. C. & S. Co.
Louisville Elec. Wks.
Munsell & Co., Eugene.
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Newton Rubber Wks.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Platt, O. S.
Simplex Electrical Co.
Standard Paint Co.
Standard Underground C. Co.

**Insulated Wires and Cables—Magnet Wire.**
American Electrical Works.
Brixey, W. R.
Brodie Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Ins. Wire Co.
Eastern Electric Cable Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
General Electric Co.
Independent Electric Co.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.

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Central Electric Co.
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General Electric Co.
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Partrick & Carter Co.
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Westinghouse Elec. & Mfg Co.

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Electric Appliance Co.
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(See Insulated Wires.)

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Harrington, Son & Co., E.
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Manistee Iron Wks. Co.

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Johns Mfg. Co., H. W.
Munsell & Co. Eugene.

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Independent Electric Co.
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Belknap Motor Co.
Brush Electric Co.
Central Electric Co.
Colburn El. Mfg. Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Elec. Engr. & Supply Co.
Elliott-Lincoln Elec. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Roth Bros. & Co.
Royal Electric Co.
Sioux City Brass Works.
Standard Electric Co.
Stanley Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
Walker Mfg. Co.
Westinghouse El. & Mfg Co.

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Garlock Packing Co.

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Electric Appliance Co
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General Electric Co.
Hayes, Fyfe Co.

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Klipstein & Co., A.

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Boston Braid Mfg. Co.

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Electric Appliance Co.
Ostrander & Co., W. R
Partrick & Carter Co.

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Colgate Co., Geo. L.
Diamond Electric Co.
Queen & Co. Inc.

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Goubert Mfg. Co.
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Bradbury-Stone Elec. S Co.
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Brixey, W. R.
Central Electric Co.
Chicago Ins. Wire Co.
Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Paint Co.

**Telegraph Apparatus.**
Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

**Telephones and Telephone Material.**
Andrae & Sons, J.
Central Electric Co.
Farr Tel. & Const. Supply Co.
Forsyth & Fisk.
Gillette, E. & F.
Gustafson, W. A.
Mianus Electric Co.
Mo. Telephone Mfg. Co.
Partrick & Carter Co.
Phila. Telephone Co.
Public Telephone Co.
Standard Tel. & Elec. Co.
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Wagner Elec. Mfg. Co.

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Westinghouse El. & Mfg. Co.

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Replogle Governor Wks.
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Rose Poly. Institute.

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Leffel & Co., Jas
Replogle Governor Wks.
Smith, S. Morgan.

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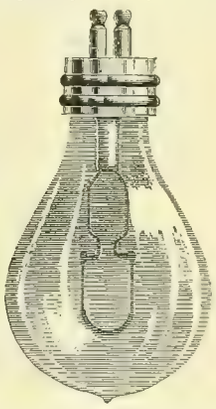

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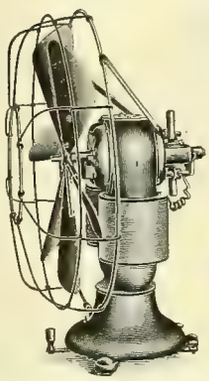

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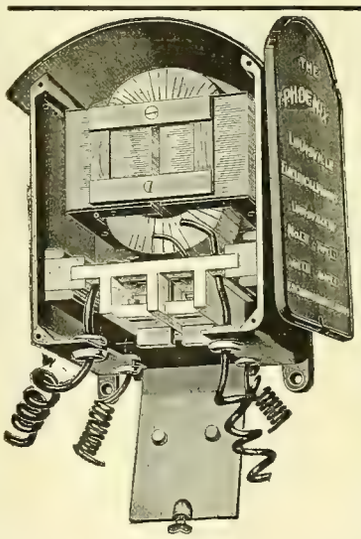

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All government, indeed every human benefit and enjoyment, every virtue, and every prudent act, said Edmund Burke, is founded on compromise and barter. We balance inconveniences; we give and take; we remit some rights that we may enjoy others; and we choose rather to be happy citizens than subtle disputants. As we must give away some natural liberty, to enjoy civil advantages; so we must sacrifice some civil liberties, for the advantages to be derived from the communion and fellowship of a great empire. But, in all fair dealings, the thing bought must bear some proportion to the purchase paid.

### A "JINER" IN THE SURF.

You probably remember the story told in verse of the old lady, who, when asked the occupation of her husband, replied that he was a "jiner," because his entire time was taken up in "jining" secret societies, writes the Rambler of the New York Mail and Express.

The people who know Dr. David S. Skinner in Brooklyn—that is, the folks who are intimate enough with him to presume on such a familiarity—say that he is the champion "jiner" of the country, because he is a member of thirty-one secret societies, and next week he will be a member of thirty-two, because, after much persuasion, he has been induced to join the Masonic Veterans' Association, which, as its name describes, is composed of veterans in the masonic order. Dr. Skinner has taken his thirty-second degree, and has been a free mason for twenty-five years or more, which qualifies him for admission.

—o—

It is natural to suppose that a man who holds membership in such an unusually large number of secret organizations would either forget some of the signs, grips, or pass-words or get them confused, and that is just what has happened to the doctor on numerous and divers occasions.

The divers occasion was last summer when he went down to Manhattan Beach for a dip. He saw a fat, florid gentleman far out beyond the breakers making certain motions which Dr. Skinner at first took to be masonic signals of distress. He swam out to render assistance, and when he got within speaking distance the fat man suddenly made several movements indicating that he belonged to the Order of the Seven Wise Men. Before the doctor had time to swim half a dozen yards more the other swimmer made known with great rapidity that he was a Knight of Pythias, an Odd Fellow, a Mystic Shriner and one of the Sons of Rest.

"Trying to beat my record," said Dr. Skinner, blowing a shower of salt water from his mouth, and getting his hands above the surface of the water, "I guess I'll see how much that chap knows." And he gave him the grand hailing sign of the Red Men, the Knights of the Golden Eagle, the Order of the Golden Chain and the Knights of Honor.

—o—

Thereupon the fat man turned over on his back and began signaling with great rapidity. He told in pantomime that he was one of the Order of Druids, a Forester, a Knight of Maccabees, a son of the Legion of Justice, an American Mechanic, a past grand worthy companion of the Home Circle, an Elk, and one of the Sons of America.

"Great Scott!" said Dr. Skinner, "I wonder what I've struck? I'll make another effort at him anyway," and he gave the signs of fourteen other orders so fast that he had to tread water to keep himself afloat. "I guess that will settle him," he remarked, but it didn't. The fat man let himself sink, held his hands above the water and worked off seventeen more separate and distinct signs of that many societies. "I'm through," remarked Dr. Skinner, as he turned to swim ashore, "I guess that fellow is a past master of the Concentrated Order of Everything."

# DAYTON ELECTRIC CEILING FANS

For 110, 220, 250, 500 Volts D. C. and Arc Circuits.

Give absolute satisfaction.
They are a pronounced success in every detail.
If you want the best, send us your orders for

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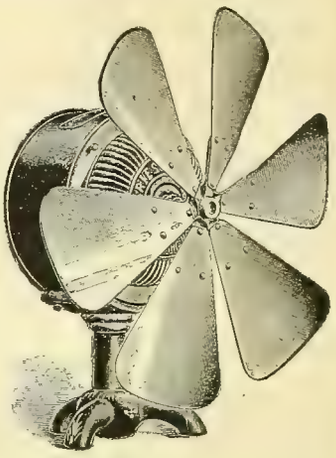

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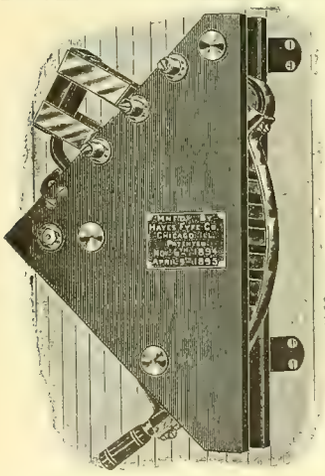

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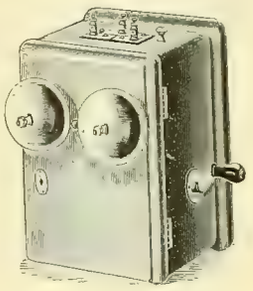

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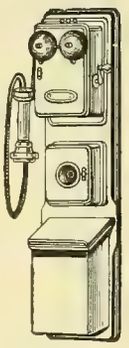

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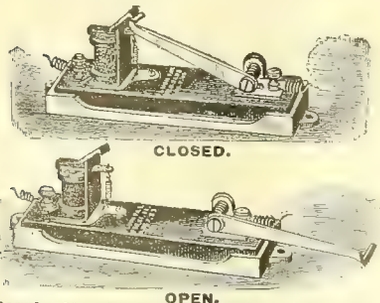

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Regular Size, 6 inches long, 2¾ inches high, 1 to 1¼ inches wide.

In a suit brought against F. Stevens by the Cutter Company, claiming an infringement on an Electric Flush Switch, it was decided in his favor by the United States Court in December last, the Court dismissing the case with costs.

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WE CLAIM

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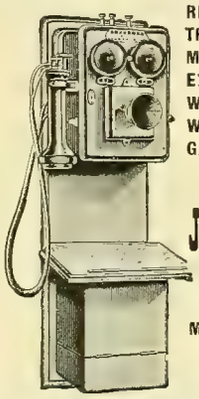

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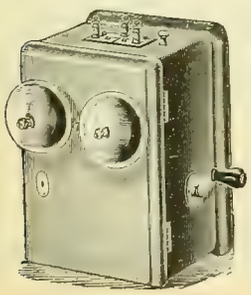

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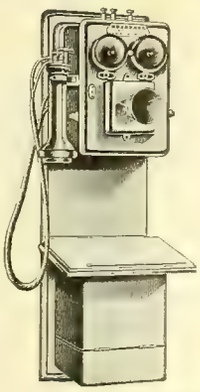

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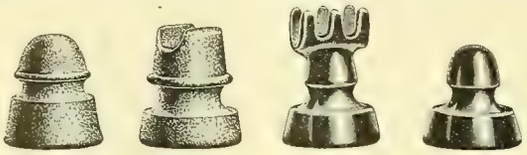

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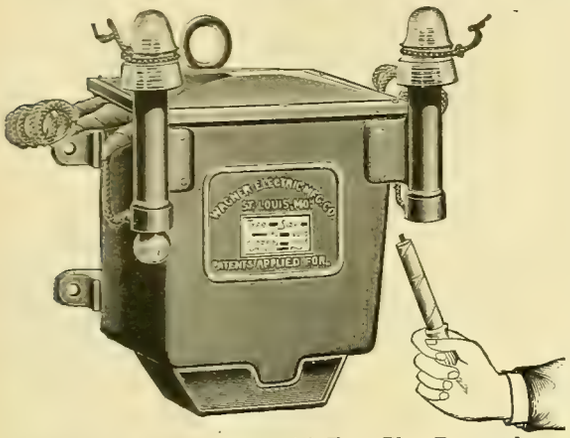


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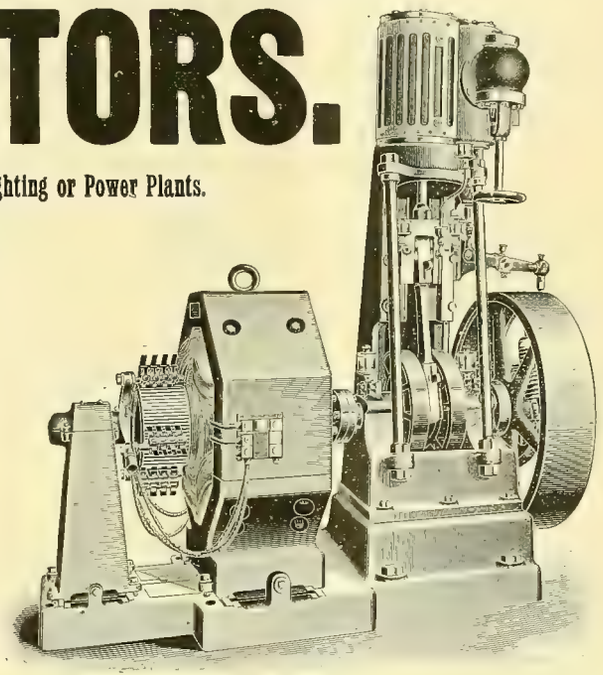

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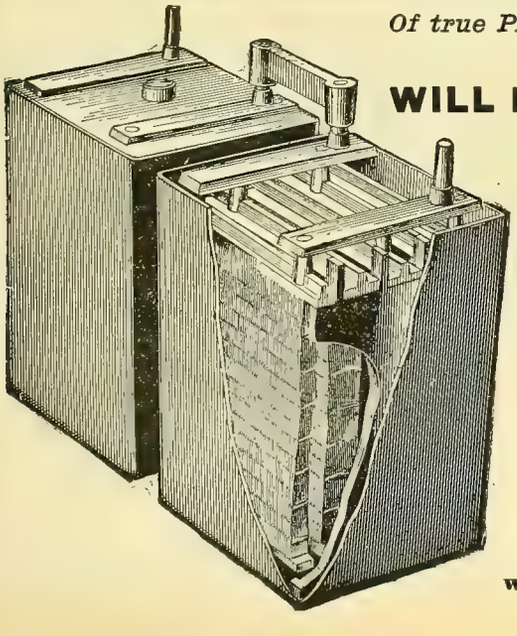

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Will give or receive without injury, currents that would destroy other batteries.

**WILL NOT SULPHATE, DISINTEGRATE OR BUCKLE.**

Contain no asbestos or other separating material to increase their internal resistance.

**ESPECIALLY ADAPTED TO CENTRAL STATION AND POWER-HOUSE SERVICE.**

Absolutely free circulation of electrolyte preventing discharge of one plate into another.

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For efficiency, reliability, durability, and capacity to receive and yield excessive currents, they are unequaled by any other battery on the market in this country.

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☞ CHALLENGE: We will place an equal number of these cells in series-circuit with any other cells of like capacity, and submit them to charge and discharge currents as high as the circuit can give and receive; and we guarantee no distortion or deterioration of plate in our cells under currents that no other cell will withstand.

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Paranite Wire.

## We Have "Troubles"

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### NONE SUCH

Exist where our high grade materials are used and specified, such, for instance, as **Paranite** and **"O. K." Wires** with all joints carefully made with our **Acme** and **Paranite Tapes.**

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Manufacturer of Mast Arms, Pole and Swinging Hoods, House Brackets and other Specialties for Construction Work. — *Catalogues and Prices furnished on application.*

*can be of use to you*

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**SAMSON SPOT CORD**

For Arc Light and Trolley Cord.

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This system does not infringe the patents of the Bell Telephone or Western Electric Co. We build exchanges complete for local companies, or will install and operate exchanges ourselves at a low monthly rental. We keep in stock Blake transmitters and all kinds of supplies.

**MANUFACTURERS OF THE SHAVER LONG DISTANCE PULVERIZED CARBON**

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**For Exchanges, Etc.**

**Correspondence Solicited.**

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## P. & B. Armature and Field Coil Varnish.

## P. & B. Insulating Compound.

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**We are the sole manufacturers of the P. & B. products which have been the STANDARD for ten years.**

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| Metropolitan Elec. Co., | NEW YORK. | Robert W. Blackwell, |
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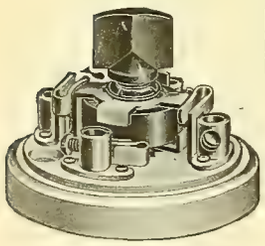
STANDARD SWITCHES, 5 and 10 ampere S. P.
10 amp. 3 and 4-way, 10, 15, 30 and 50 amp. D. P.



## FLUSH SWITCHES

Of any of the above sizes, either on single plates or with any number of switches upon one plate.

***Cut illustrates 4-way or commutation switch, controls a light or group of lights from any desired number of points.***

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*The Valentine-Clark Co.,*

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## For Electrical Purposes

Guaranteed 98/99% and free of lead and iron. If you want the best quality ask your dealer for this brand. Imported by

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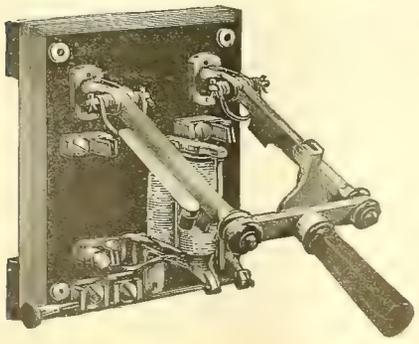

You can prevent them from burning out by using

## THE BRODIE AUTOMATIC MOTOR-SWITCH.

It combines in one piece of apparatus a double-pole switch, adjustable limit-switch and automatic cut-out, and instantly disconnects the motor whenever it is overloaded and whenever the circuit fails from any cause.

Agents wanted in all sections of the country.

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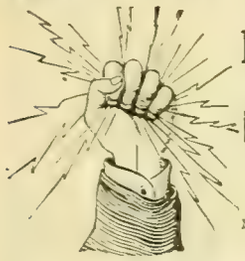

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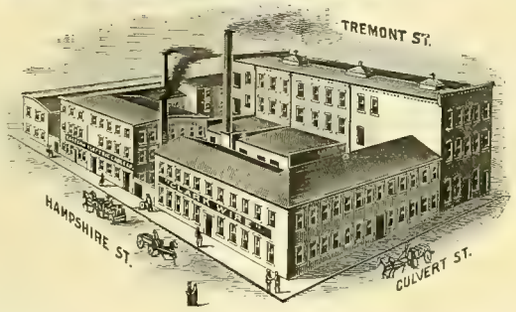


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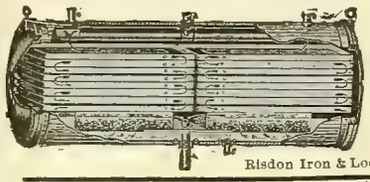

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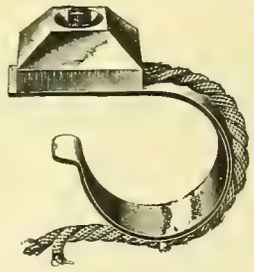

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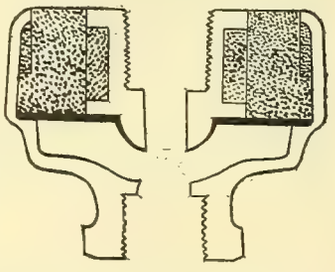

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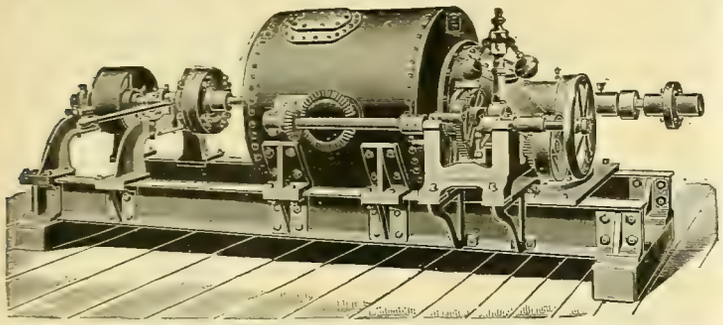

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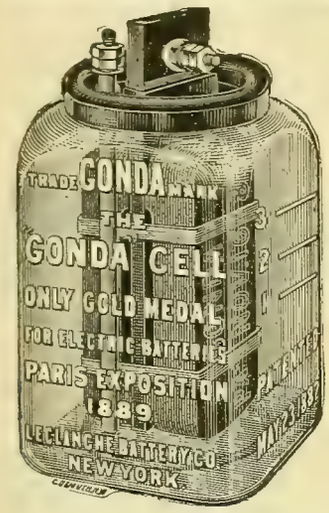


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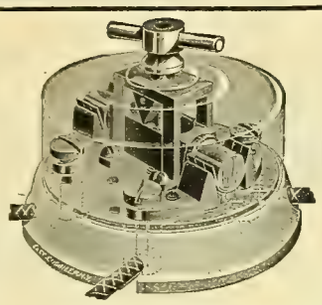

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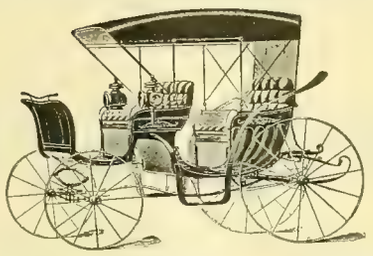

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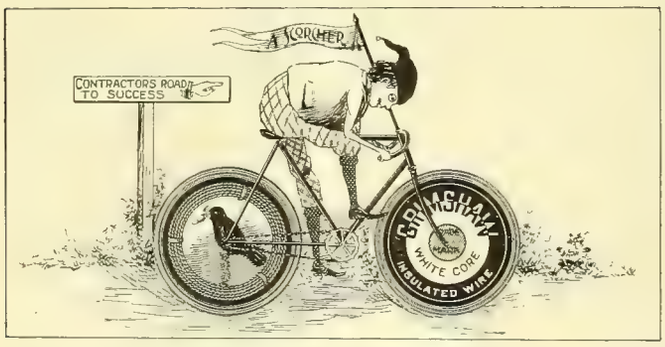


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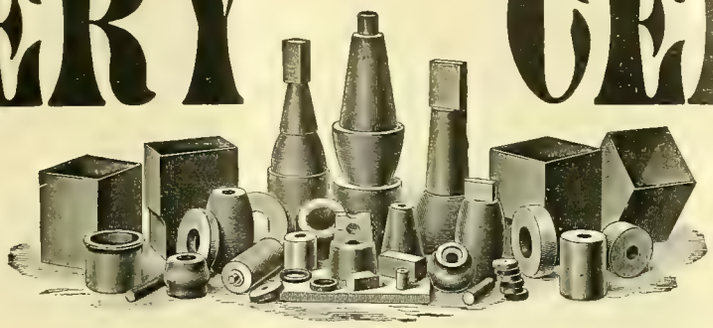

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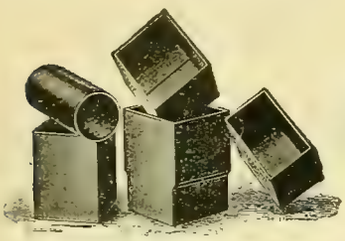

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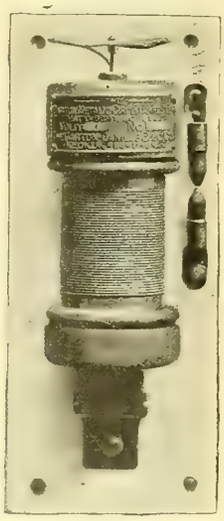

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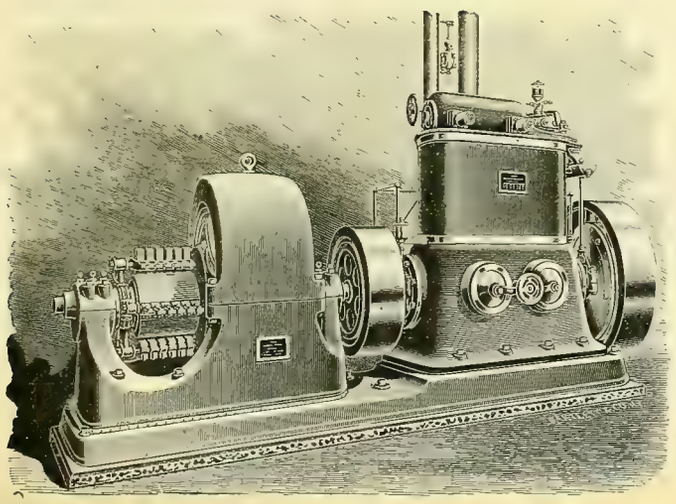

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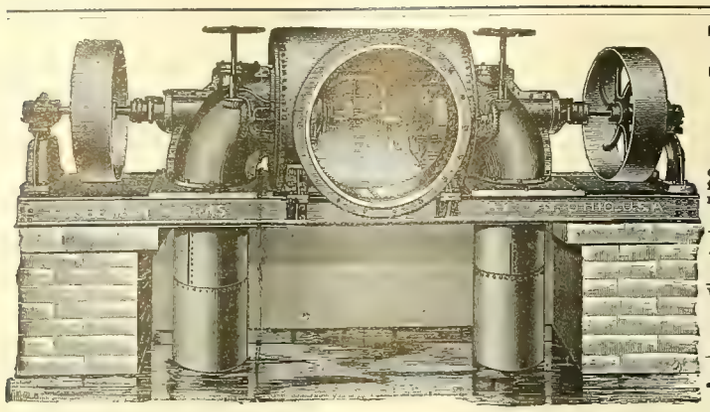

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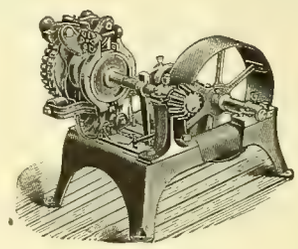

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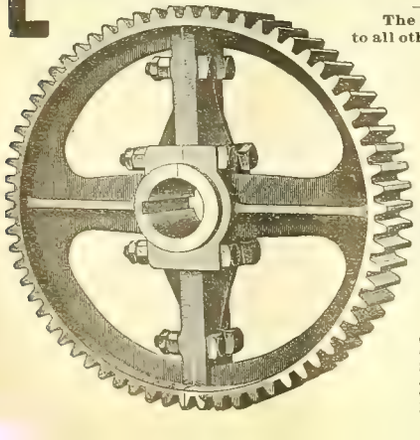

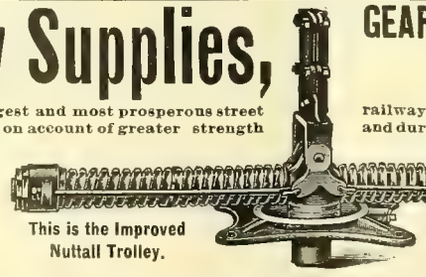

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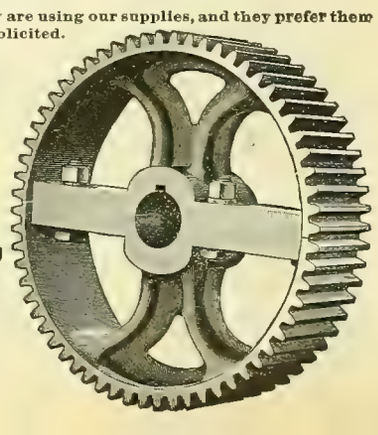

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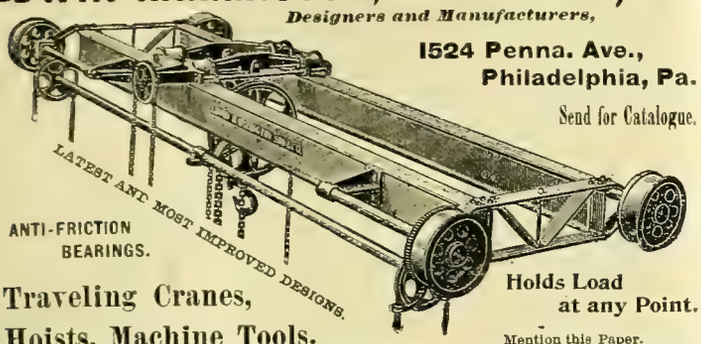


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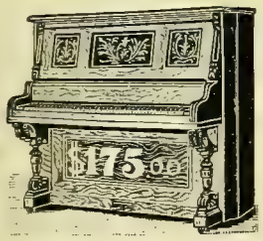


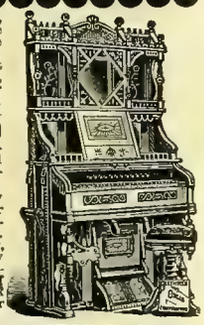

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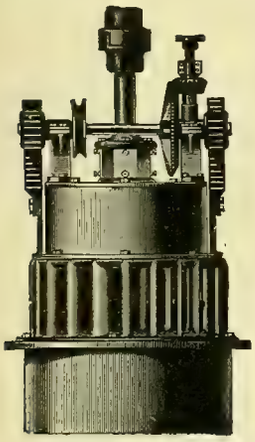

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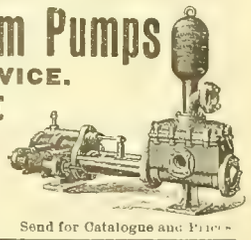

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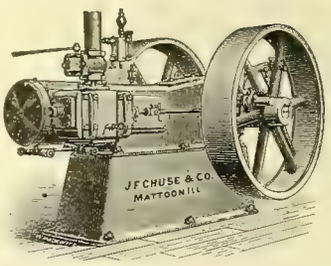


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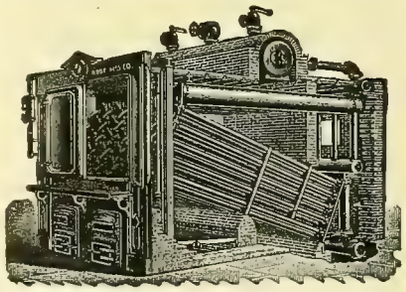

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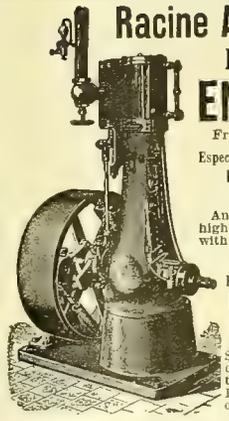

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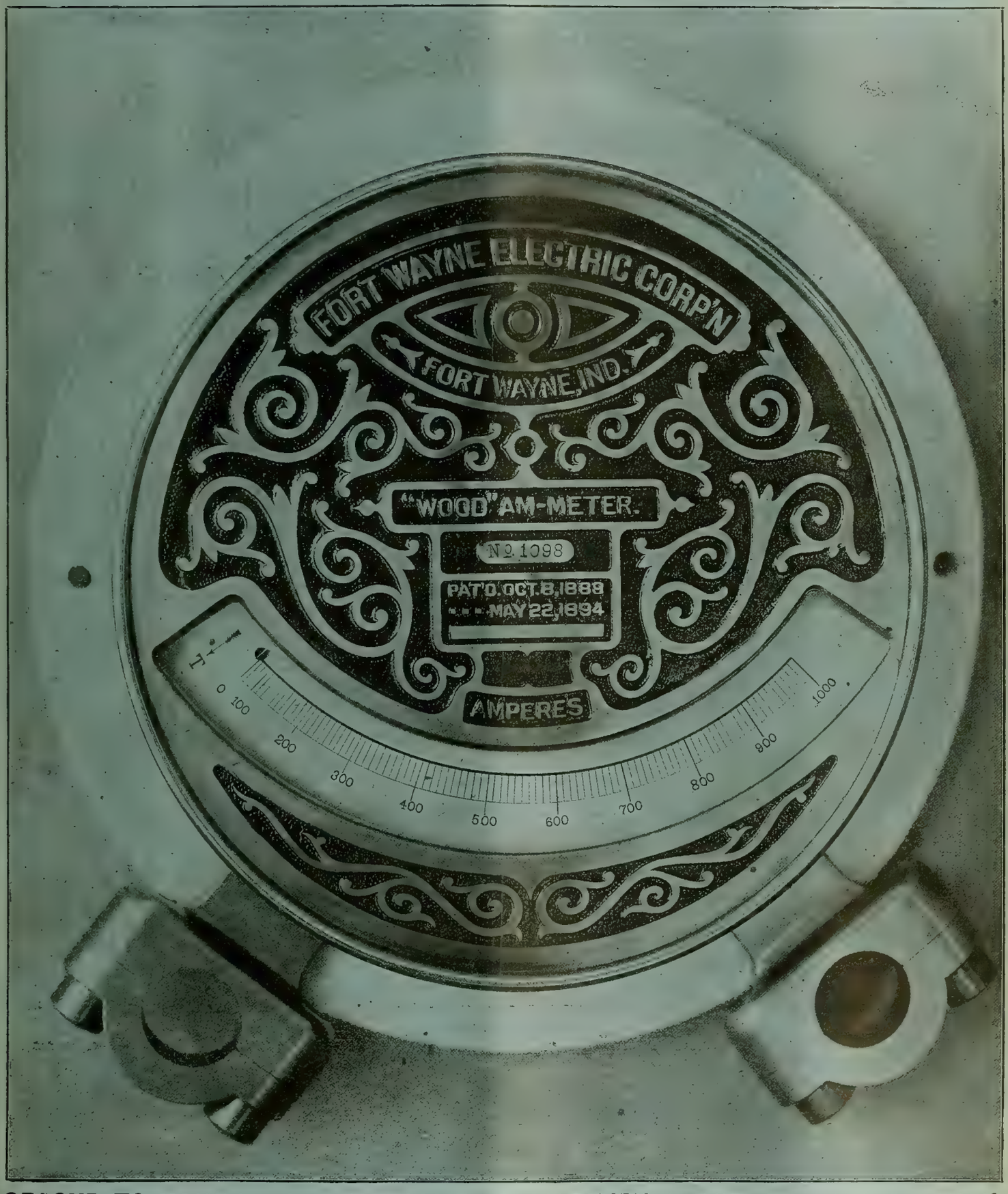


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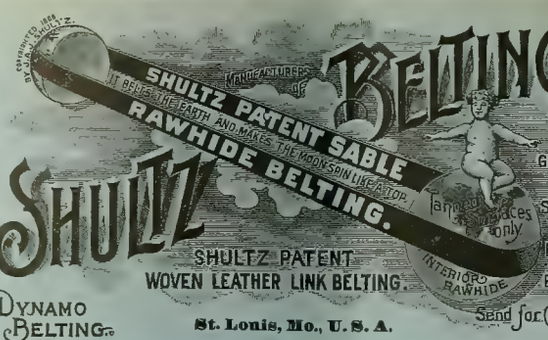


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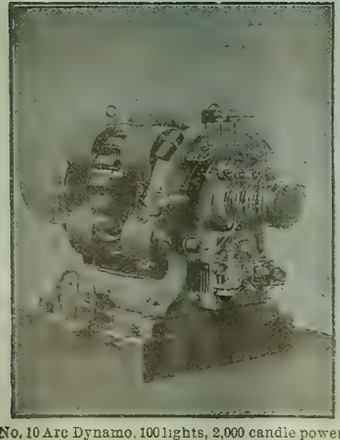

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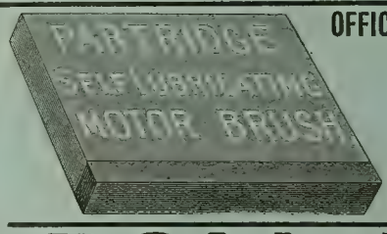


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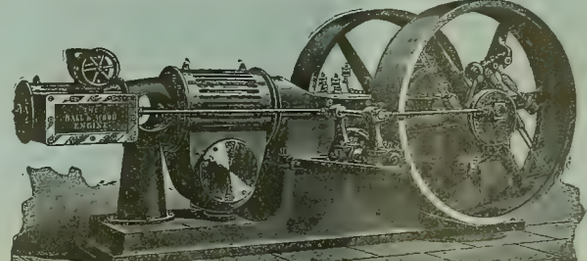

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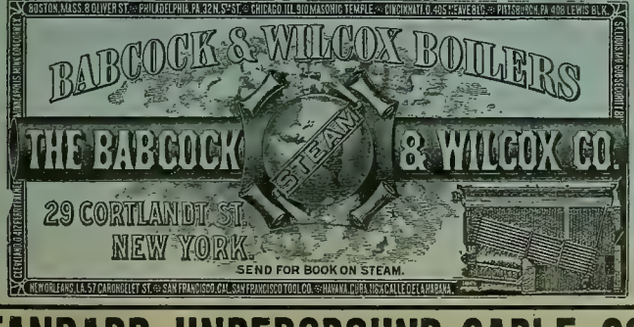


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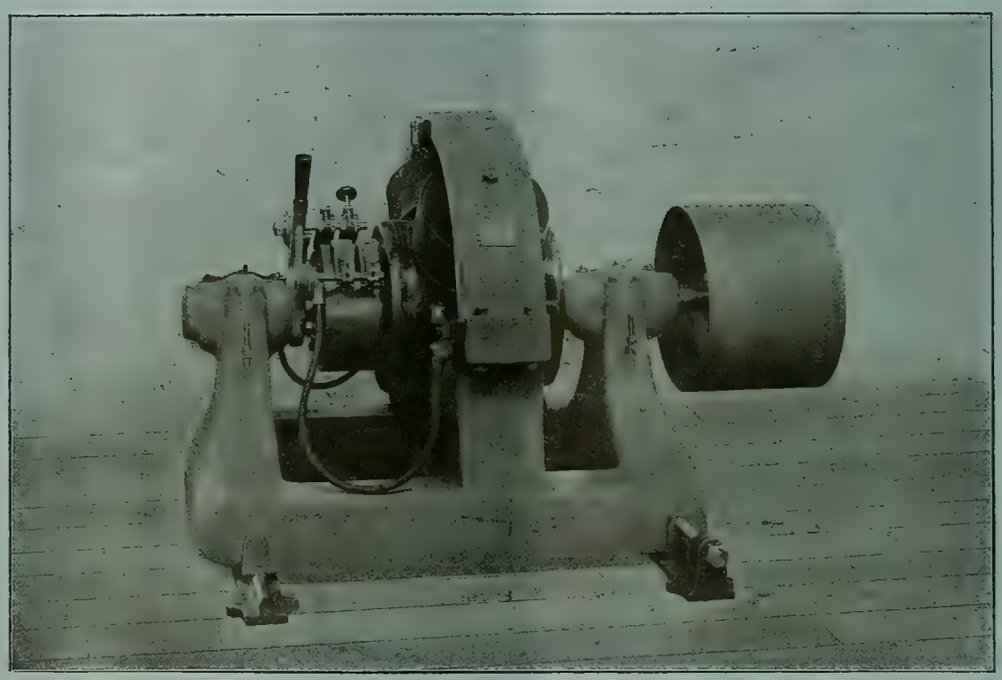

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## CLASSIFIED LIST.


**Accumulators.**
Bradbury-Stone Elec. S. Co.
Electric-Power Storage Co.
Electric Storage Battery Co.

**Annunciators.**
Central Electric Co.
Chicago Gen'l Fixture Co.
Electric Appliance Co.
Ostrander &Co., W. R.
Partrick & Carter Co.

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Chicago Gen'l Fixture Co.
Corey, R. B.
Crocker-Wheeler Elec. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Helios Electric Co.
Solar Electric Co.
Standard Electric Co.
Standard Thermometer Co.
Waterman, C. H.
Westinghouse El. & Mfg. Co.

**Arc Light Cord.**
Samson Cordage Wks.

**Batteries and Jars.**
Andrae & Sons, J.
Boynton Multivolt Batt'y Co.
Bradbury-Stone Elec. S. Co.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Central Electric Co.
Chicago Gen'l Fixture Co.
Commercial Elec. Sup. Co.
Edgerton Pottery Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Hemingray Glass Co.
Leclanche Battery Co., The.
Miamisburg Electric Co
Newton Rubber Wks.
Partrick & Carter Co.
Western Electric Co.

**Bells.**
Andrae & Sons, J.
Central Electric Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Gillette, E. & F.
Huebel & Manger.
Ostrander & Co., W. R.
Partrick & Carter Co
Western Electric Co.

**Belting.**
Shultz Belting Co.

**Boilers.**
Abendroth & Root Mfg. Co.
Babcock & Wilcox Co., The.
Clonbrock Steam Boiler Co.
Moyes, L. M.
Racine Hardware Co.
Weston Engine Co.

**Books, Electrical.**
Electrician Publishing Co.

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Besly & Co., Chas. H.
Phosphor Bronze Sm.Co.,Ltd.

**Brushes.**
Belknap Motor Co.
Boudreaux Dyn. Brush Co.
Central Electric Co.
Partridge Carbon Co.

**Burglar Alarms.**
Central Electric Co.
Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

**Cables** (See Insulated Wires.)

**Cables, Electric** .(See Insulated Wires), **Copper, Sheet and Bar.**
American Elec. Works.
Brixey, W. R.
Central Electric Co.
Chicago Ins. Wire Co.
Eastern Electric Cable Co.
Elec. Engr. & Supply Co.
Moore, Alfred F.
New York Ins. Wire Co.
Simplex Electrical Co.
Standard Underground C.Co.
Western Electric Co.

**Carbons, Points & Plates.**
Central Electric Co.
Chicago Gen'l Fixture Co.
Corey, R. B.
DeRonde & Co., A.
General Electric Co.
Hardtmuth & Co., F.
Partridge Carbon Co.
Reisinger, Hugo.
Wertheim, Ed.
Western Electric Co.

**Carriages and Buggies.**
Henney Buggy Co.

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Southgate & Co., W. B.

**Compound.**
Standard Paint Co.

**Conduits.**
Central Electric Co.
Interior Conduit & Ins. Co.

**Construction & Repairs.**
Crocker-Wheeler Elec. Co.
Ft. Wayne Elec. Corporation.
Interstate Com. El. Const. Co.
Royal Electric Co.

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Arnold, B. J.
Bain, Foree.
Brush Electric Co.
Bryan, Wm. H.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Goltz & Sinclair.
Interior Conduit & Ins. Co.
Royal Electric Co
Siemens & Halske Elec. Co.
Standard Electric Co.
United Elec Improvement Co
Walkins, Louis E.
Westinghouse Elec & Mfg. Co.
Western Electric Co.
Woods & Co., C. E.

**Copper.**
Besly & Co., Chas. H.
Miamisburg Electric Co.

**Copper Wire Bought.**

**Copper Wires.**
American Electrical Works.
Besly & Co., Chas. H.
Brixey, W. R.
Bunnell & Co., J. H.
Central Electric Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.
National India Rubber Co.
Okonite Co. The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Western Electric Co.

**Cordage.**
Samson Cordage Wks.

**Cranes.**
Harrington, Son & Co., E.

**Cross-Arms, Pins and Brackets.**
Anderson, Albert & J. M.
Brady, T. H.
Central Electric Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Nuttal Co., R. D.
Partrick & Carter Co.

**Cut-Outs and Switches.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Bryant Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Edison Co.
Chicago Gen'l Fixture Co.
Colgate Co., Geo. L.
Commercial Elec. Sup. Co.
Crocker-Wheeler Elec. Co.
Cutter Electrical & Mfg. Co.
Diamond Electric Co.
Eddy Elec. Mfg. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric Protection Co.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Forest City Elec. Wks.
Forsyth & Fisk.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hart & Hegeman Mfg. Co.
Huebel & Manger.
Interior Conduit & Ins. Co.
Louisville Elec. Wks.
Nuttall Co., R. D.
Partrick & Carter Co.
Platt, O. S.
Royal Electric Co.
Solar Electric Co.
Wagner Elec. Mfg. Co.

**Dynamos.**
Brush Electric Co.
Central Electric Co.
Colburn El. Mfg. Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Elliott-Lincoln Elec. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Roth Bros. & Co.
Royal Electric Co.
Siemens & Halske Elec. Co.
Standard Electric Co.
Walker Mfg. Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

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Fuel Economizer Co.

**Electric Railways.**
Brush Electric Co.
General Electric Co.
Siemens & Halske Elec. Co.
Westinghouse El. & Mfg. Co.

**Electrical and Mechanical Engineers.**
Arnold, B. J.
Bain, Foree.
Bryan, Wm. H
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Ford, Owen.
Goltz & Sinclair.
Thayer Electric Co.
Walkins, Louis E.
Woods & Co., C. E.

**Electrical Instruments.**
Anderson, Albert & J. M.
Bunnell & Co., J. H.
Central Electric Co.
Commercial Elec. Sup. Co.
Diamond Electric Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Interior Conduit & Ins. Co.
Nuttall Co., R. D.
Partrick & Carter Co.
Platt, O. S.
Queen & Co. Inc.
Southgate & Co., W. B.

**Electrical Specialties.**
Clark El. Specialty Mfg. Co.
Electric Protection Co.
Interstate Com. El. Const Co.
S. K. C. Specialty Co.

**Electroliers, etc.**
Edwards, W. S. Mfg. Co.

**Electro-Plating Mach'y.**
Besly & Co., Chas. H.
Colburn El. Mfg. Co.
General Electric Co.

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Otto Gas Engine Wks.

**Engines, Steam.**
Ball & Wood Co., The.
Chuse & Co., J. F.
Racine Hardware Co.
Westinghouse Machine Co.
Weston Engine Co.

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Chic. Electro & Stereo Co.
Illinois Eng. Co.

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Goubert Mfg. Co.

**Fibre.**
Butler Hard Rubber Co.
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**Files.**

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Western Electric Co.

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Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.

**Gas Lighting, Electric.**
Partrick & Carter Co.

**Gears.**
Besly & Co., Chas. H.
Nuttall Co., R. D.

**General Elec. Supplies.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Besly & Co., Chas. H.
Bryant Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Edison Co.
Chicago Gen'l Fixture Co.
Colgate Co., Geo. L.
Commercial Elec. Sup. Co.
Cutter Electrical & Mfg. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric Protection Co.
Elliott-Lincoln Elec. Co.
Farr Tel. & Const. Supply Co.
Forest City Elec. Wks.
General Electric Co.
Goltz & Sinclair.
Hayes, Fyfe Co.
Interior Conduit & Ins. Co.
Louisville Elec. Wks.
Metropolitan Electric Co.
Mianus Electric Co.
Morris & MacCurdy.
Partrick & Carter Co.
Platt, O. S.
Queen & Co. Inc.
Sioux City Brass Works.
S. K. C. Specialty Co.
Solar Electric Co.
Standard Tel. & Elec. Co.
Thayer Electric Co.

**Globes and Electrical Glassware.**
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Edwards, W. S. Mfg. Co.
Hemingray Glass Co.

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Dixon Crucible Co., Jos.

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Butler Hard Rubber Co.
Fiberite Co.. The.
Newton Rubber Wks.

**Insulators and Insulating Materials.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Brixey, W. R.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Central Electric Co.
Chicago Ins. Wire Co.
Commercial Elec. Sup. Co.
Crocker-Wheeler Elec. Co.
Cutter Elec. & Mfg. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Empire China Works.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Hart & Hegeman Mfg. Co.
Hemingray Glass Co.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Louisville Elec. Wks.
Munsell & Co., Eugene.
National India Rubber Co.
Newton Rubber Wks.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Platt, O. S.
Simplex Electrical Co.
Standard Paint Co.
Standard Underground C.Co.

**Insulated Wires and Cables—Magnet Wire.**
American Electrical Works.
Brixey, W. R.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Ins. Wire Co.
Commercial Elec. Sup. Co.
Eastern Electric Cable Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
General Electric Co.
Independent Electric Co.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C.Co.

**Lamps, Incandescent.**
Am. Electrical Mfg. Co.
Buckeye Electric Co.
Central Electric Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Globe Electric Light Co.
New York & Onio Co.
Partrick & Carter Co.
United Elec. Imp. Co.
Westinghouse Elec. & Mfg Co.

**Lightning Arresters.**
Colgate Co., Geo. L
Diamond Electric Co.
Electric Appliance Co.
General Electric Co.

**Magnet Wire.**
(See Insulated Wires.)

**Mechanical Machinery**
Besly & Co., Chas. H.
Harrington, Son & Co., E.
Lukens Iron & Steel Co.
Manistee Iron Wks. Co.

**Mica.**
Johns Mfg. Co., H. W.
Munsell & Co. Eugene.

**Mining Apparatus, Elec.**
General Electric Co.
Independent Electric Co.

**Motors.**
Andrae & Sons, J.
Belknap Motor Co.
Brush Electric Co.
Central Electric Co.
Colburn El. Mfg. Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Elec. Engr. & Supply Co.
Elliott-Lincoln Elec. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Roth Bros. & Co.
Royal Electric Co.
Sioux City Brass Works.
Standard Electric Co.
Stanley Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
Walker Mfg. Co.
Westinghouse El. & Mfg Co.

**Packing.**
Besly & Co., Chas. H.
Garlock Packing Co.

**Paints.**
Morris & MacCurdy.
Standard Paint Co.

**Patents.**
Gooch, Chas. J.

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Phosphor Bronze Sm.Co. Ltd

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Beethoven Piano & Organ Co

**Platinum.**
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Nuttall Co., R. D.
Valentine-Clark Co.

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Empire China Works.
General Electric Co.
Hemingray Glass Co.

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Electric Appliance Co
Partrick & Carter Co.

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Central Electric Co.
General Electric Co.
Hayes, Fyfe Co.
Royal Electric Co,

**Sal Ammoniac.**
Klipstein & Co., A.

**Silk Braid.**
Boston Braid Mfg. Co.

**Speaking Tubes.**
Central Electric Co.
Electric Appliance Co.
Ostrander & Co., W. R
Partrick & Carter Co.

**Speed Indicators**
Besly & Co., Chas. H.
Colgate Co., Geo. L.
Diamond Electric Co.
Queen & Co. Inc.

**Steam Heating.**
Goubert Mfg. Co.
Webster & Co., Warren.

**Storage Batteries.**
Bradbury-Stone Elec. S Co.
Electric-Power Storage Co.
Electric Storage Battery Co.

**Street Cars.**
Brill, J. G. Co.

**Tapes, Insulating.**
American Electrical Works.
Brixey, W. R.
Central Electric Co.
Chicago Ins. Wire Co.
Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Paint Co.

**Telegraph Apparatus.**
Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

**Telephones and Telephone material.**
Andrae & Sons, J.
Central Electric Co.
Commercial Elec. Sup. Co.
Farr Tel. & Const. Supply Co.
Forsyth & Fisk.
Gillette, E. & F.
Gustafson, W. A.
Mianus Electric Co.
Mo. Telephone Mfg. Co.
Partrick & Carter Co.
Phila. Telephone Co.
Public Telephone Co.
Standard Tel. & Elec. Co.
U. S. Tel. Const. Co.
Universal Telephone Co.
Western Electric Co.
Western Tel. Const. Co.

**Transformers.**
Central Electric Co.
Chicago Gen'l Fixture Co.
Diamond Electric Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hornberger Elec. Mfg. Co.
Louisville Elec. Wks.
Royal Electric Co.
Stanley Electric Mfg. Co.
Wagner Elec. Mfg. Co.

**Trolley Cord.**
Samson Cordage Wks.

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General Electric Co.
Westinghouse El. & Mfg. Co.

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Dayton Globe Iron Works Co.
Leffel & Co., Jas.
Replogle Governor Wks.
Smith, S. Morgan.
Stillwell-Bierce & Smith-Vaile Co.

**Universities.**
Int. Corr. Schools.
Rose Poly. Institute.

**Water Wheels.**
Leffel & Co., Jas
Replogle Governor Wks.
Smith, S. Morgan.

**Wire, Bare.**
Anderson, Albert & J. M.
Besly & Co., Chas. H.
Bishop Gutta Percha Co,
Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
Independent Electric Co.
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Nuttall Co., R. D.
Okonite Co., The.
Phillips Insulated Wire Co

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ST. LOUIS, AUG. 1st, 1895.

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Gentlemen:-The management and control of the COMMERCIAL ELECTRICAL SUPPLY COMPANY has been changed, the Messrs. Einstein, who heretofore held the control of this Company, having disposed of their entire interest in the same to Mr. Jos. Franklin and his son, Mr. Jos. Franklin, Jr.

The present officers of the Company are, Jos. Franklin, Jr., President and Jos. Franklin Secretary and Treasurer.

The New management wish to thank all their customers for their past favors, and hope, by their increased facilities, to extend their business through a greater territory, bearing in mind that good material, prompt shipment and low prices will always gain trade.

Soliciting your patronage, we remain,

Yours most respectfully,

COMMERCIAL ELECTRICAL SUPPLY CO.

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The success of the **Pharos Lamp** has not been the result of extravagant laudation or plethoric advertising. It is rather the legitimate outgrowth of the careful attention given to perfecting the details of manufacture, and in practical ways endeavoring to construct a lamp which would return a profit to the purchaser. We have not assumed that you are in business for your health.

OKONITE IT NEVER DISAPPOINTS

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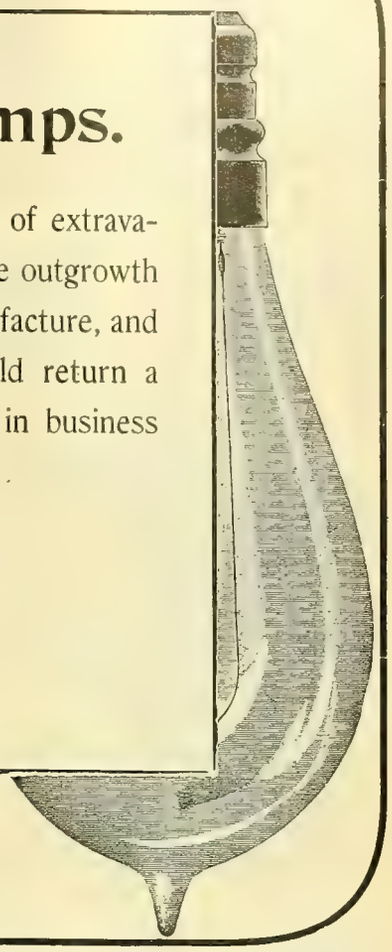
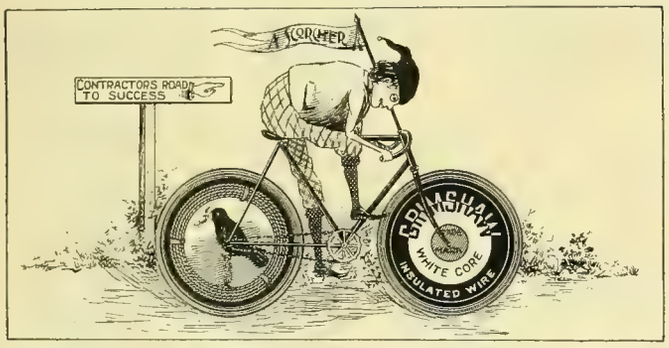
**CHICAGO.**



BRANCHES.
**ST. LOUIS: Southern Electrical Supply Co.**
**KANSAS CITY: Gate City Electric Co.**
**NEW ORLEANS: 1010 Canal St.**

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**RAVEN WHITE CORE.** Used in some of the largest buildings in the United States.

**COMPETITION LINE WIRE.** Used by some of the largest Central Stations and Fire and Police Departments in the U.S.

**GRIMSHAW TAPES, COMPETITION TAPES AND SPLICING COMPOUNDS.**

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BRANCHES: CHICAGO: 320 Dearborn St. BOSTON: 134 Congress St. SAN FRANCISCO: 102 Sacramento St.

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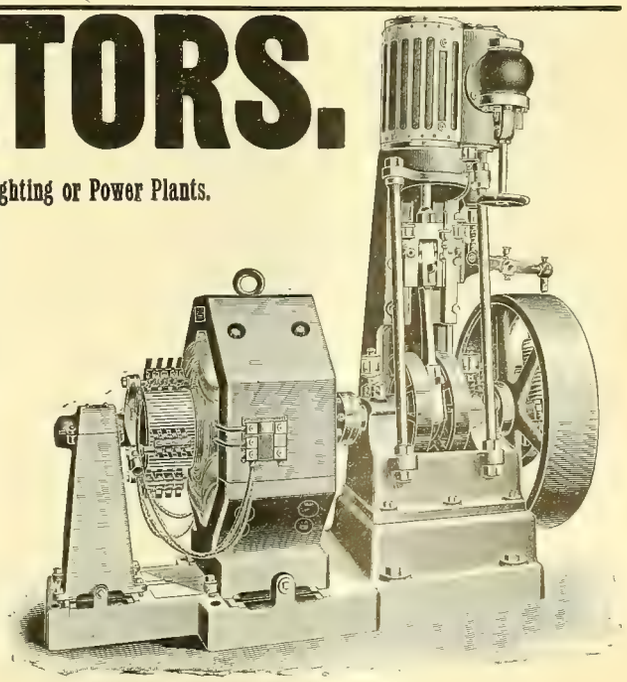
**Direct Connected or Belted for Electric Railways, Central Stations, Isolated Lighting or Power Plants.**



## EDDY MOTORS—SLOW, MEDIUM OR HIGH SPEED.

***We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.***

## THE EDDY ELECTRIC MFG. CO.,

***WINDSOR, CONN.***

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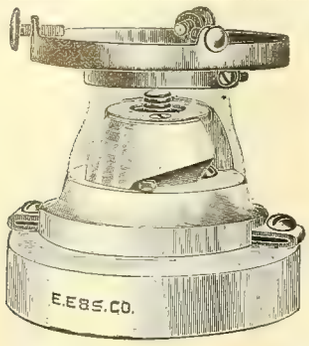
BOSTON, G. M. Angier & Co., 64 Federal St.
ELMIRA, S. N. Blake.
ST. LOUIS, Western Electrical Supply Co.
KANSAS CITY, W. T. Osborn.

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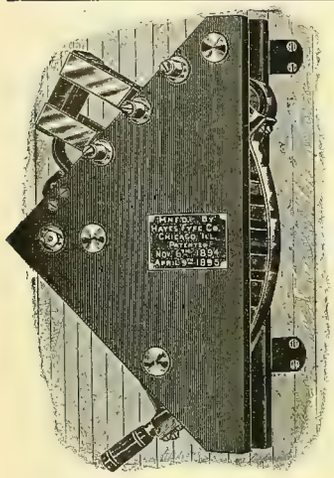

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Made for any Power.

Costs Less than Old Styles.

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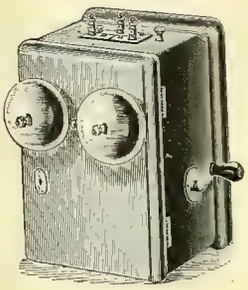

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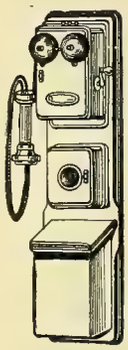
Hunnings, Blake and Ball TRANSMITTERS, RECEIVERS.

**Telephone Wood Work.**

INDUCTION COILS, DESK TELEPHONES, DESK TRANSMITTERS,

And all parts of Telephones. Special prices on large lots.

*Send for Catalogue.*



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# The S. K. C. Two Phase Alternating Current System.

THE FIRST AND ONLY COMPLETE AND PERFECTED SYSTEM BY WHICH LIGHT AND POWER CAN BE SUPPLIED FROM THE SAME GENERATOR AND CIRCUITS. POWER TRANSMISSION AND DISTRIBUTION MADE PRACTICAL AND COMMERCIALLY SUCCESSFUL.

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Our system is much more simple and consequently more durable than any other, either direct or alternating.

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**Patents**—Our apparatus is novel, different from anything heretofore made, and covered by patents that fully protect us and our customers. We are not infringing patents belonging to others, and shall avail ourselves of the patents under which we operate to protect ourselves from piracy by other manufacturers.

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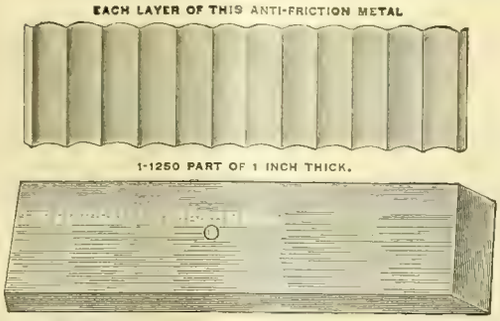


The Boudreaux Dynamo Brush Co. NO WOVEN WIRE.

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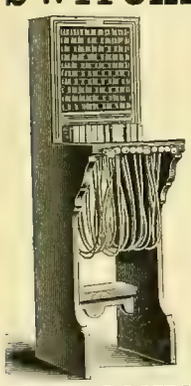

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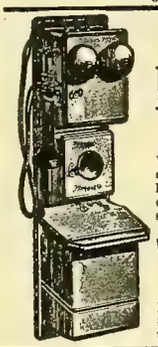

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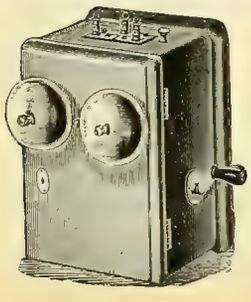

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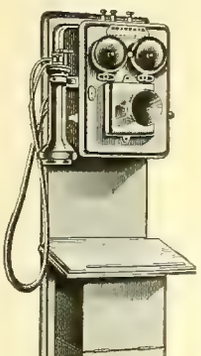

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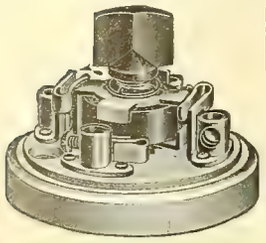

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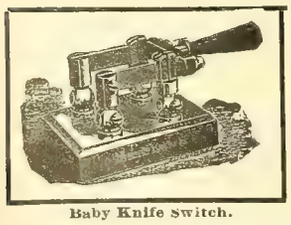

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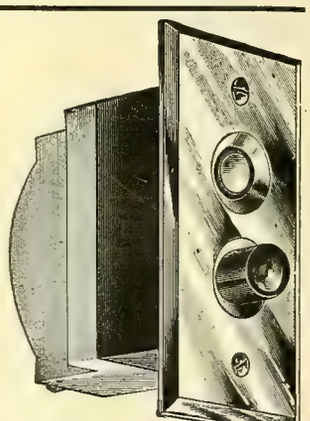

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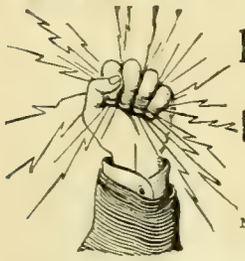

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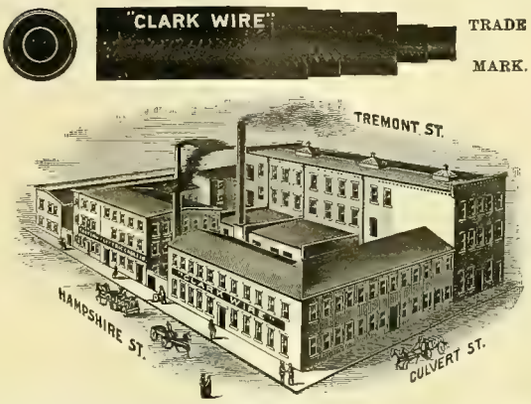


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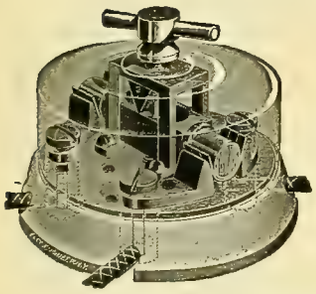

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HAVE COME AND GONE, BUT THE

## NEW ENGLAND SWITCH

IS STILL THE

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TRY THEM AND WONDER WHY YOU EVER USED ANY OTHER.

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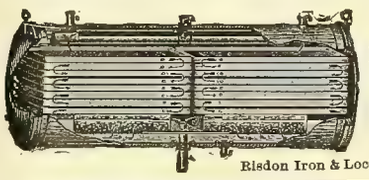

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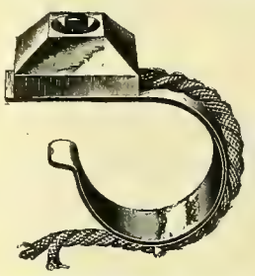

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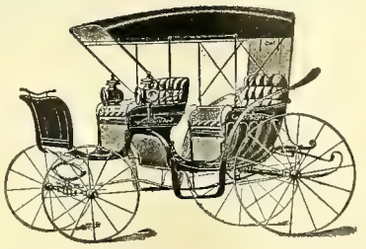

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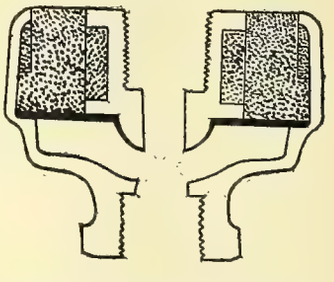

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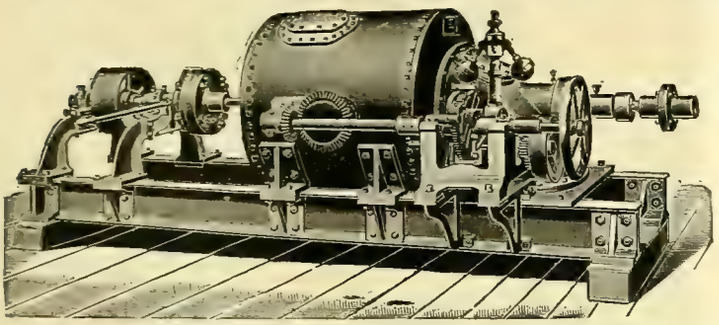

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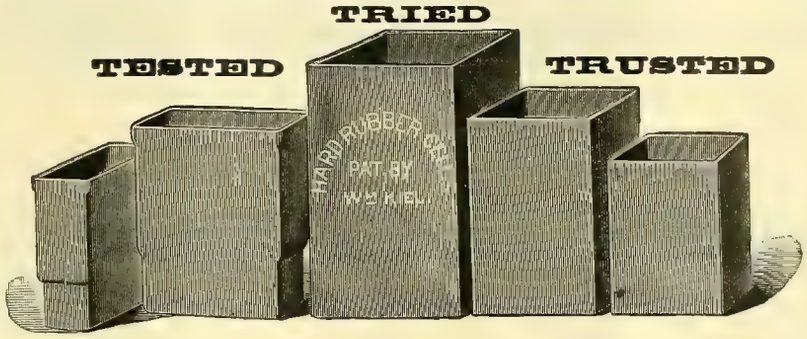


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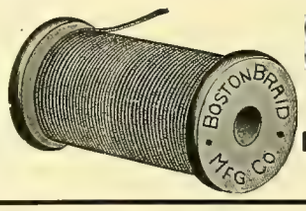


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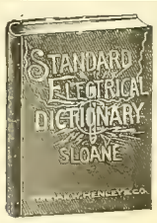


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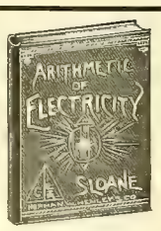


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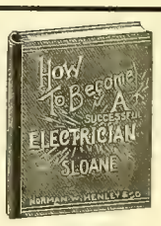


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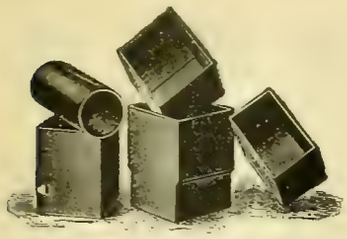

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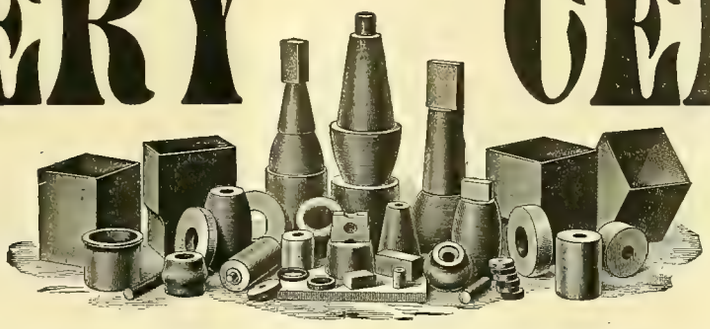

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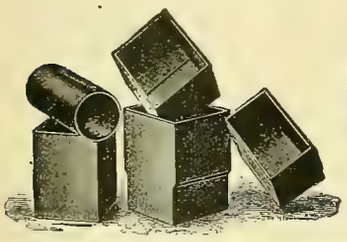

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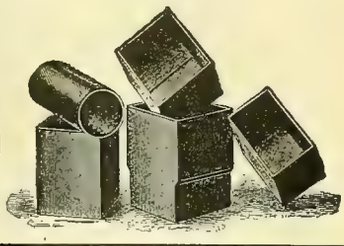

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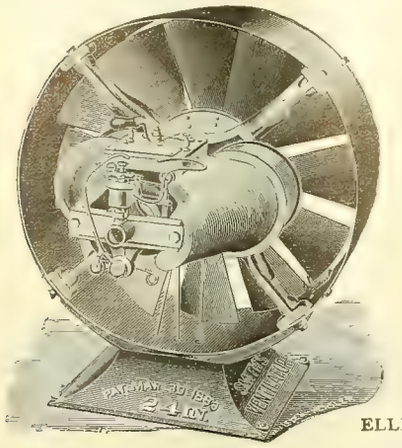

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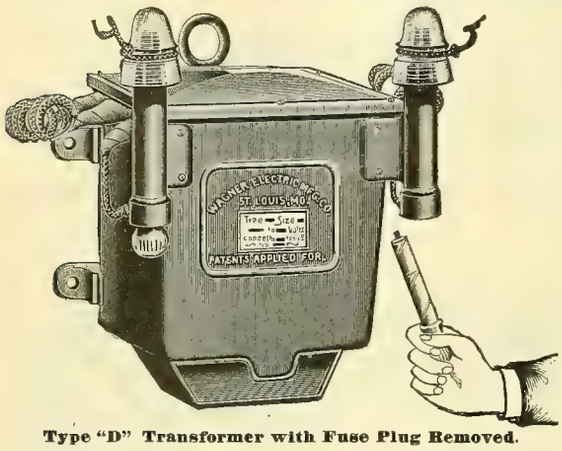


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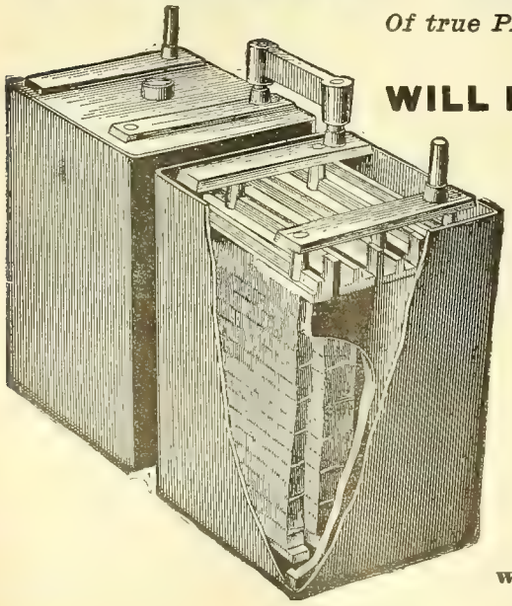

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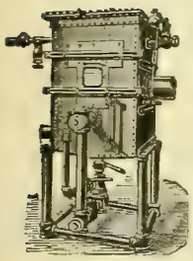

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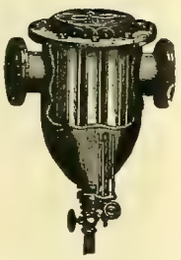

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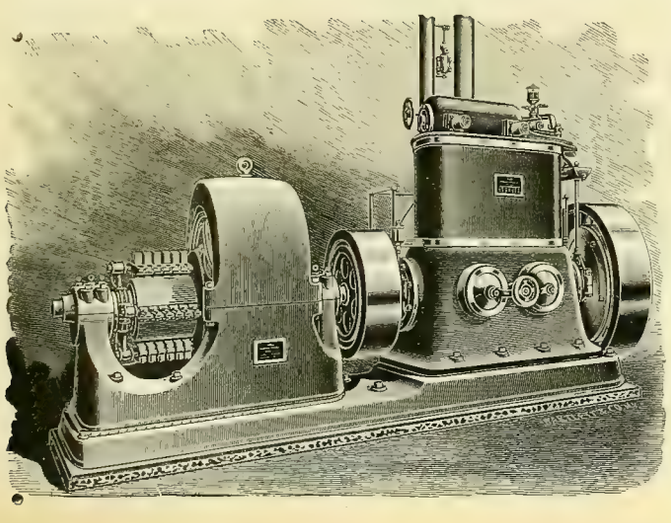

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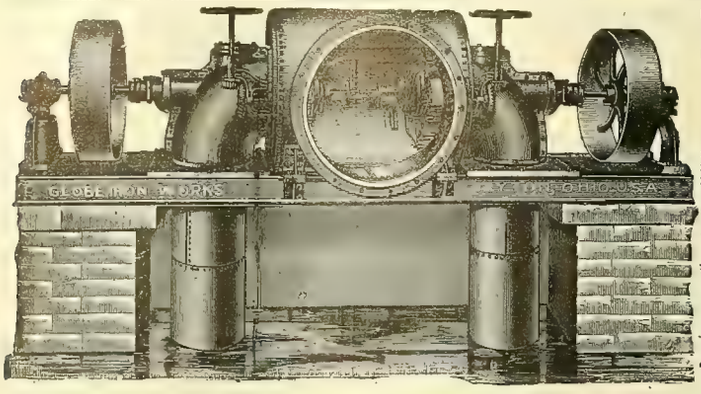

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|---|---|---|---|---|---|
| Whole Gate | 16.06 | 119.17 | 141.58 | 205.27 | 79.76 |
| ⅞ " | 16.42 | 122.00 | 127.18 | 195.19 | 82.58 |
| ¾ " | 16.78 | 117.33 | 112.60 | 175.74 | 82.18 |
| ⅝ " | 17.03 | 111.83 | 98.12 | 149.99 | 79.31 |
| ½ " | 16.88 | 118.67 | 82.07 | 118.40 | 75.52 |

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| | Head. | Rev. per Min. | Cu. Ft. per Sec. | Horse Power. | Per Cent |
|---|---|---|---|---|---|
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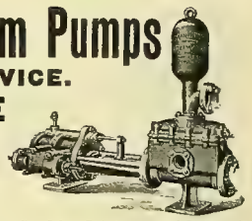

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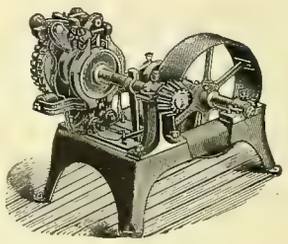

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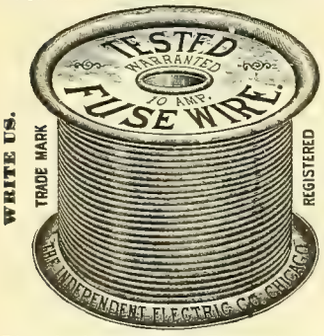


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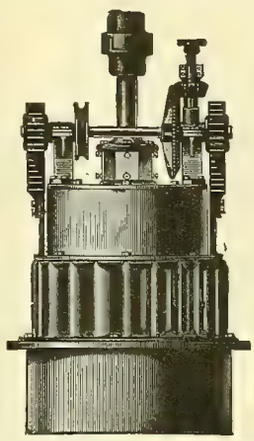

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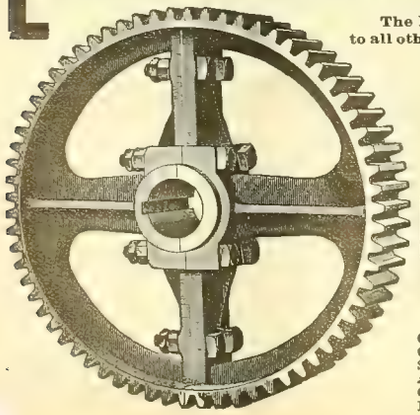

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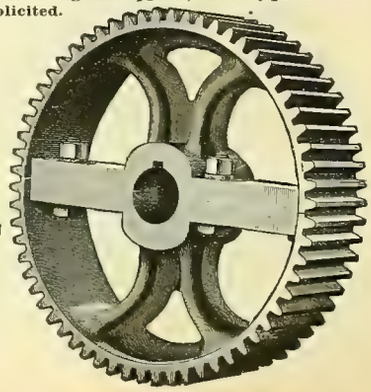

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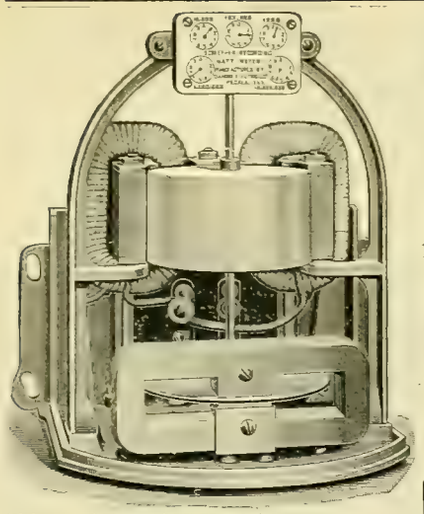

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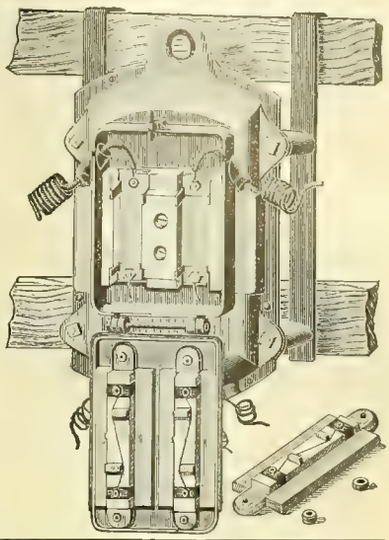

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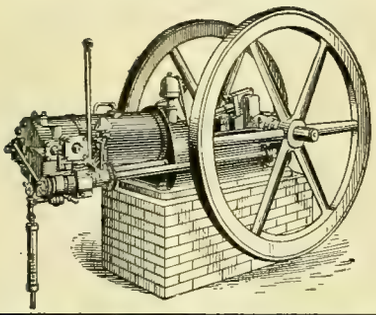

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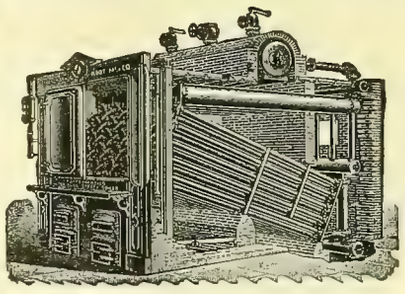

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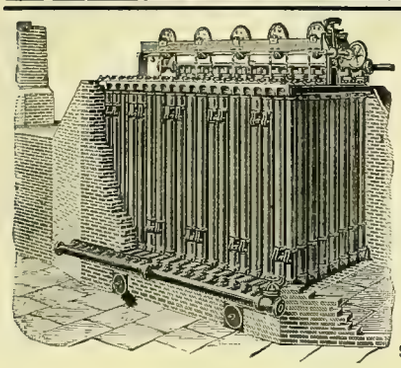

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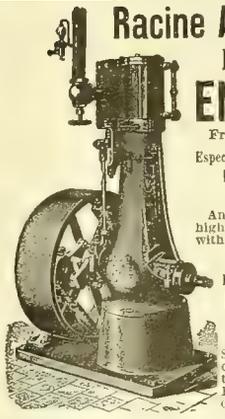

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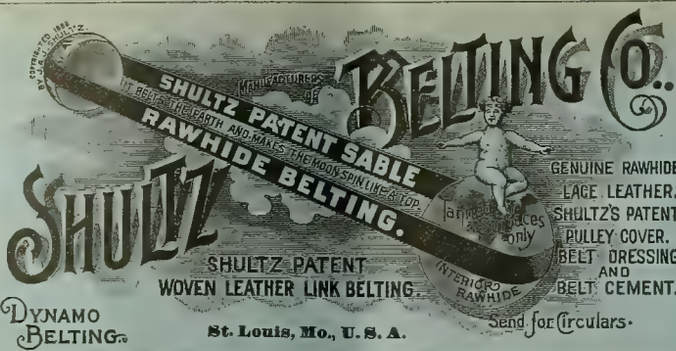


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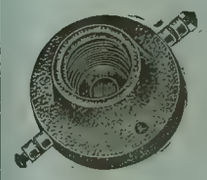

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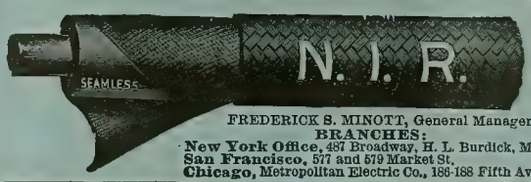


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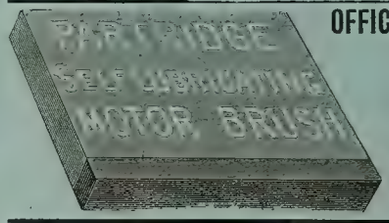


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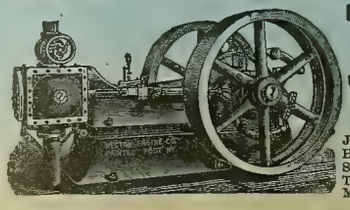

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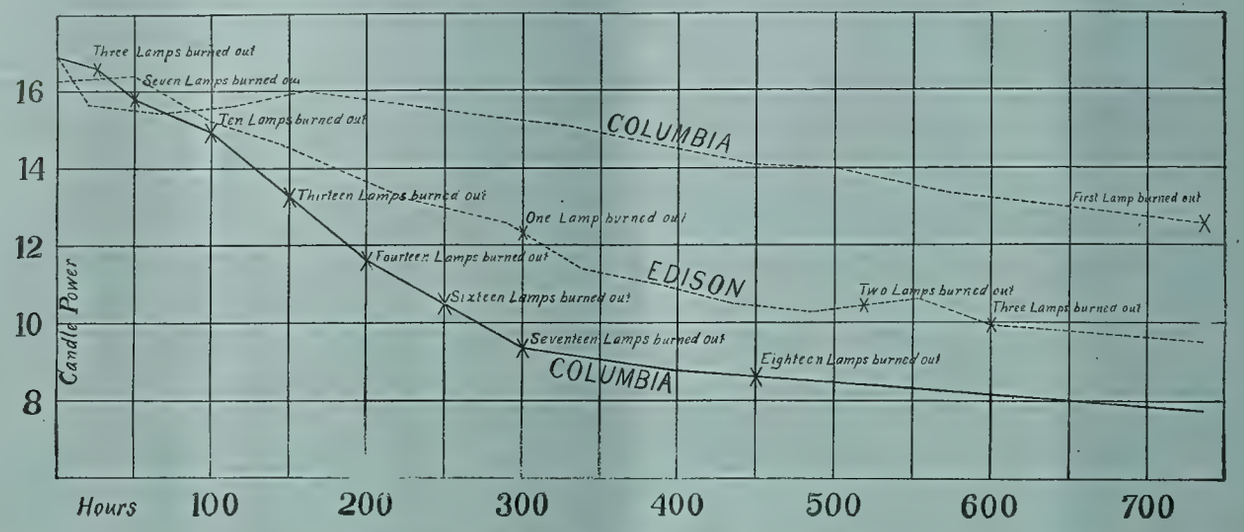


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Central Electric Co.
Interior Conduit & Ins. Co.
Roth Bros. & Co.

**Feed Water Heaters.**
Goubert Mfg. Co.

**Fibre.**
Butler Hard Rubber Co.
Vulcanized Fibre Co.

**Fire Alarms.**
Partrick & Carter Co.
Western Electric Co.

**Fuse Wire.**
Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.

**Gas Lighting, Electric.**
Partrick & Carter Co.

**Gears.**
Besly & Co., Chas. H.
Nuttall Co., R. D.

**General Elec. Supplies.**
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Andrae & Sons, J.
Besly & Co., Chas. H.
Bryant Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Edison Co.
Chicago Gen'l Fixture Co.
Colgate Co., Geo. L.
Commercial Elec. Sup. Co.
Cutter Electrical & Mfg. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric Protection Co.
Elliott-Lincoln Elec. Co.
Farr Tel. & Const. Supply Co.
Forest City Elec. Wks.
General Electric Co.
Goltz & Sinclair.
Hayes, Fyfe Co.
Interior Conduit & Ins. Co.
Louisville Elec. Wks.
Metropolitan Electric Co.
Mianus Electric Co.
Morris & MacCurdy.
Partrick & Carter Co.
Platt, O. S.
Queen & Co. Inc.
Sioux City Brass Works.
S. K. C. Specialty Co.
Solar Electric Co.
Standard Tel. & Elec. Co.
Thayer Electric Co.

**Globes and Electrical Glassware.**
Edgerton Pottery Co.
Edwards, W. S. Mfg. Co.
Hemingray Glass Co.

**Graphite Specialties.**
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.

**Hard Rubber Goods.**
Butler Hard Rubber Co.
Fiberite Co.. The.
Newton Rubber Wks.

**Insulators and Insulating Materials.**
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Andrae & Sons, J.
Brixey, W. R.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Central Electric Co.
Commercial Elec. Sup. Co.
Crocker-Wheeler Elec. Co.
Cutter Elec. & Mfg. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Empire China Works.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Hart & Hegeman Mfg. Co.
Hemingray Glass Co.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Louisville Elec. Wks.
Munsell & Co.. Eugene.
National India Rubber Co.
Newton Rubber Wks.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Platt, O. S.
Simplex Electrical Co.
Standard Paint Co.
Standard Underground C. Co.

**Insulated Wires and Cables—Magnet Wire.**
American Electrical Works.
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Bunnell & Co., J. H.
Central Electric Co.
Commercial Elec. Sup. Co.
Eastern Electric Cable Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
General Electric Co.
Independent Electric Co.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Simplex Electrical Co.
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Buckeye Electric Co.
Central Electric Co.
Commercial Elec. Sup. Co.
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Globe Electric Light Co.
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Partrick & Carter Co.
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Electric Appliance Co.
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(See Insulated Wires.)

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Harrington, Son & Co., E.
Lukens Iron & Steel Co.
Manistee Iron Wks. Co.

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General Electric Co.
Independent Electric Co.

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Brush Electric Co.
Central Electric Co.
Colburn El. Mfg. Co.
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General Electric Co.
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Sioux City Brass Works.
Standard Electric Co.
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Wagner Elec. Mfg. Co.
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Garlock Packing Co.

**Paints.**
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Standard Paint Co.

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Gooch, Chas. J.

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**Platinum.**
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Hayes, Fyfe Co.
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Electric Appliance Co.
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Colgate Co., Geo. L.
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Electric Appliance Co.
Moore, Alfred F.
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Gillette, E. & F.
Gustafson, W. A.
McEvoy, C. H.
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Mo. Telephone Mfg. Co.
Partrick & Carter Co.
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General Electric Co.
Hornberger Elec. Mfg. Co.
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Royal Electric Co.
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**ELECTRICAL SUPPLIES and FIXTURES.**

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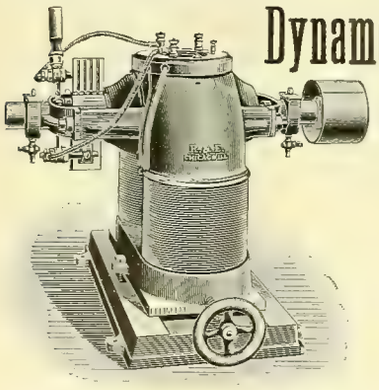

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**DYNAMOS,**
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High Efficiency, Best Material,
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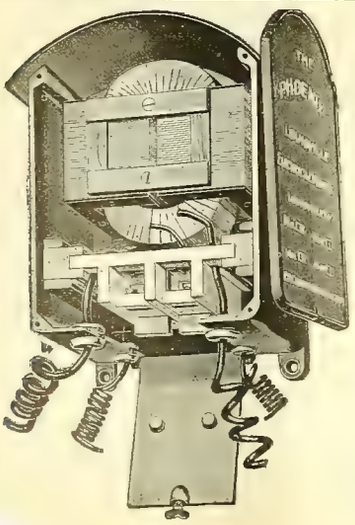

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Is **UNEQUALLED** in its

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**Telephone 4152.** **821 Pine Street.**

ST. LOUIS, AUG. 1st, 1895.

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To The ELECTRICAL FRATERNITY.

Gentlemen:-The management and control of the COMMERCIAL ELECTRICAL SUPPLY COMPANY has been changed, the Messrs. Einstein, who heretofore held the control of this Company, having disposed of their entire interest in the same to Mr. Jos. Franklin and his son, Mr. Jos. Franklin, Jr.

The present officers of the Company are, Jos. Franklin, Jr , President and Jos Franklin Secretary and Treasurer.

The New management wish to thank all their customers for their past favors, and hope, by their increased facilities, to extend their business through a greater territory, bearing in mind that good material, prompt shipment and low prices will always gain trade.

Soliciting your patronage, we remain,

Yours most respectfully,

COMMERCIAL ELECTRICAL SUPPLY CO.

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## TO MANUFACTURERS.

Space, light, heat and power **FREE** at ***Matthews, Grant County, Ind.,*** to concerns that employ a limited number of men. Ample railroad facilities, healthy location, good schools, improved streets, electric lights, etc. Address GEO. N. CATTERSON, Treas.,
24 Kentucky Ave., Indianapolis, Ind.

# MID-SUMMER THOUGHTS.

It is difficult at times, (this is one of the times) to assemble the evanescent, jagged thoughts into a coherent chain and weave them into a web of definite statement.

Every user of Okonite Wire—spite of all effort the mind wanders, escapes the toil of thinking, and jilts you. It is the season of year when the "feesh" invite you with every wibbly waggle of their gleaming tails, and the ol' swimmin' hole lures you with its placid coolness.

Interior Conduit has re—and it's just the kind of weather when it's more than pleasant to lie in the fragrant clover of the old orchard, under the golden-russet tree, and listen—listen to the droning hum of a bumble bee—listen to the woodpecker drum the pear-tree bole, and watch the doodle-bug scamper to his near-by hole—and a silver thread from a spider web floats between your drowsy eyes. Across the pasture, athwart the corn, sings the note of the dinner horn—a perfume sweet of shocked-up wheat—and Aunt Belinda's pies.

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# DAYTON ELECTRIC CEILING FANS

**For 110, 220, 250, 500 Volts D. C. and Arc Circuits.**

Give absolute satisfaction.
They are a pronounced success in every detail.
If you want the best, send us your orders for

**THE DAYTON.**

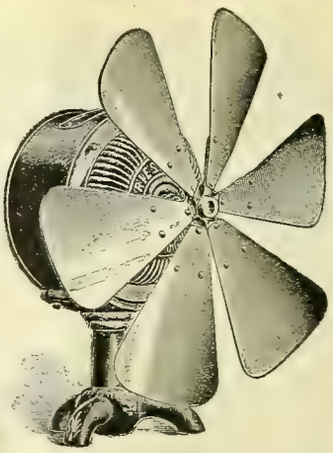
# OUR FAN MOTORS

**For 500 Volt and Arc Circuits are Perfect.**

We have a large stock on hand and can fill your orders without delay,

# ALTERNATING FAN MOTORS.

We have a limited stock of the Ries and Scott Fan Motors on hand. As we are making an exceptionally low price on them, they are going fast. If you are looking for a bargain in this line, we can accommodate you. Send us your orders at once if you wish to take advantage of low price.



**METROPOLITAN ELECTRIC COMPANY,**
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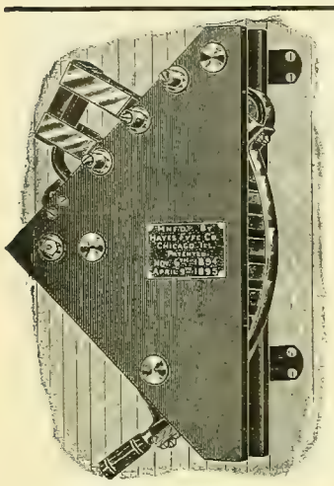

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(For Starting, Regulating and Saving Motors)

Is Automatic in Release from any Point of the Resistance.

Made with and without D. P. Switch.
Absolutely Firepoof.
Made for any Power.
Costs Less than Old Styles.

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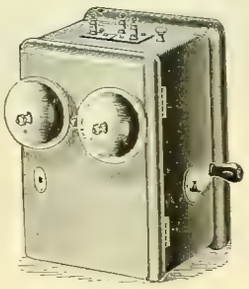

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**Hunnings, Blake and Ball**
TRANSMITTERS,
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**Telephone Wood Work.**

INDUCTION COILS,
DESK TELEPHONES,
DESK TRANSMITTERS,

And all parts of Telephones. Special prices on large lots.

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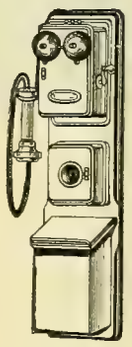

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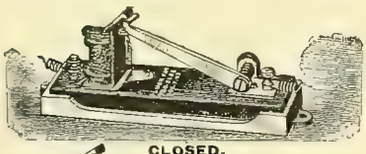

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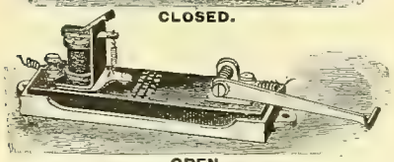

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**Regular Size, 6 inches long, 2¾ inches high, 1 to 1¾ inches wide.**

In a suit brought against F. Stevens by the Cutter Company, claiming an infringement on an Electric Flush Switch, it was decided in his favor by the United States Court in December last, the Court dismissing the case with costs.

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Owners and Manufacturers of

**THE PLUSH PROTECTORS,**

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**And General Electrical Work.**

Special attention given to the construction of models and inventors' experimental work.

**WE CLAIM**

**For the Plush Protectors,** simplicity, sure action, ready adjustment, and interchange of parts.
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**Impossible for them to get out of order.**

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**TRANSFORMERS OF ANY DESCRIPTION. DIRECT CURRENT GENERATORS AND MOTORS.**

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## USE THE BOUDREAUX DYNAMO BRUSH.

The Boudreaux Dynamo Brush Co. NO GAUZE.

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EACH LAYER OF THIS ANTI-FRICTION METAL

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This company is manufacturing **A Compound Magneto Telephone**
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This company is also prepared to fully equip Telephone exchanges, (furnishing everything from the telephone to the wire and poles). Private lines, Factory plants, etc., and do all kinds of construction work. Send for circulars and price lists.

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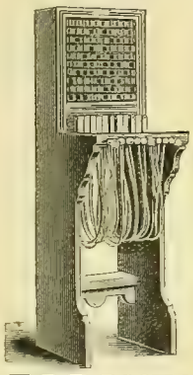
**539, 540 and 541 Monadnock Blk., Chicago, Ill.**

Telephone Exchange
# SWITCHBOARDS



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With Long Distance Blake Transmitters and Standard Magnetos.
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Guaranteed positively not infringing.
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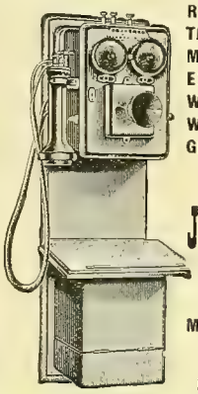
**Headquarters for** TELEPHONES, RECEIVERS, TRANSMITTERS, MAGNETO and EXTENSION BELLS, WIRE AND CORD, WOOD BRACKETS, GLASS INSULATORS.



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Our Instruments are absolutely NON-INFRINGING.

**Special Agent for Okonite Wire.**

# Subscribe for the Western Electrician.

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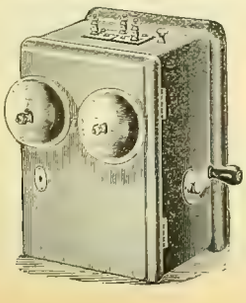

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Standard Goods. No Infringements. **TELEPHONES.** Get Our Prices Before Purchasing Elsewhere.

**E. & F. GILLETTE,**
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# The M. & B. Telephone Co.

Own letters patent No. 361,124, issued April 12, 1887, which covers all possible forms of Battery Transmitters in which the Electrodes are *not* in *constant contact*, and they are not affected in any way by the Berliner Transmitter Patent. Send in your orders.

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Perfect in Detail, of Highest Efficiency, and Best Possible Electrical and Mechanical Construction.

Sole Agents for the United States for the celebrated

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Sensitive as a Blake.
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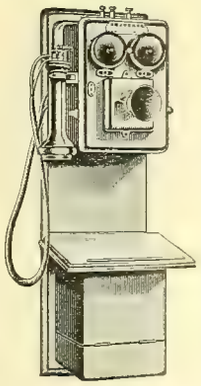
No adjustment required.
Will not Pack or get out of order.

For Simplicity, small dimensions, entire multicontact, and powerful transmission it has no equal. Adopted by Governments, Exchanges and Railways in EUROPE, ASIA and SOUTH AMERICA.



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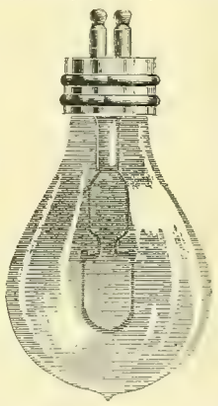

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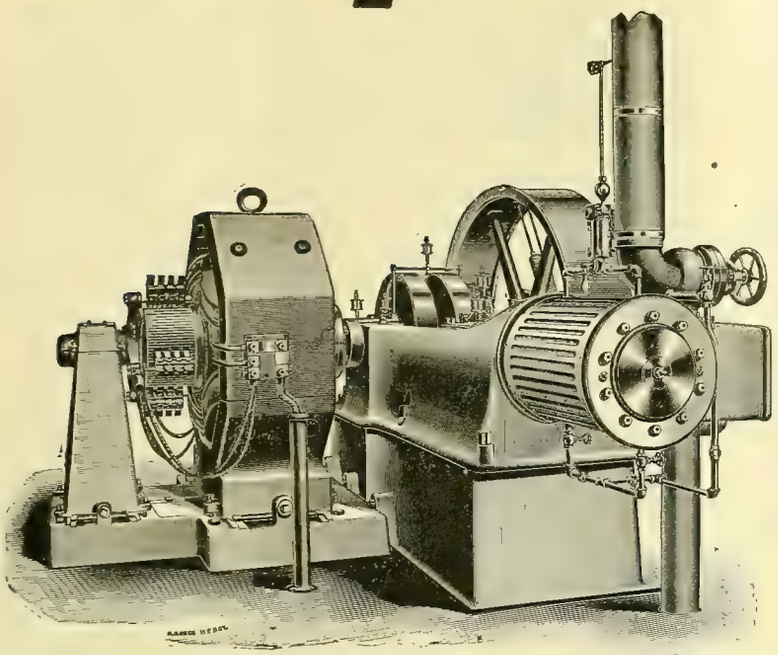

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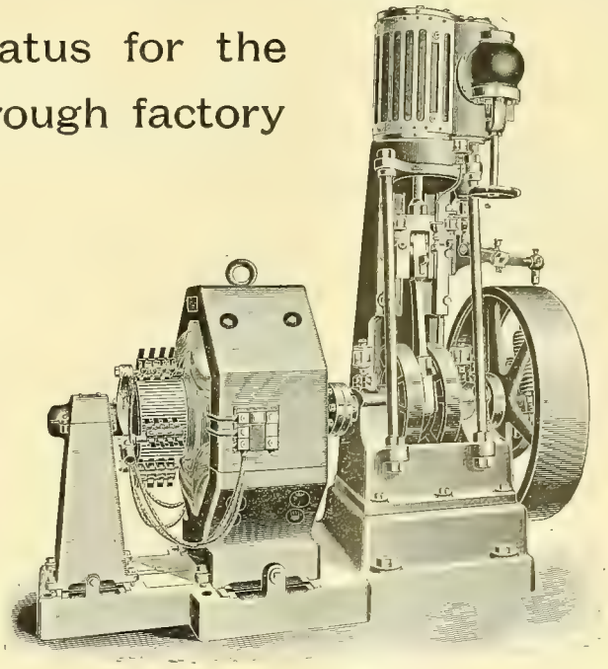

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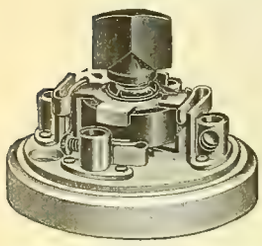

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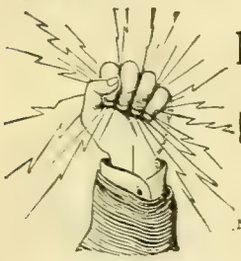

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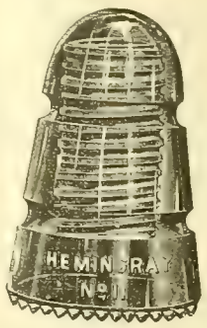


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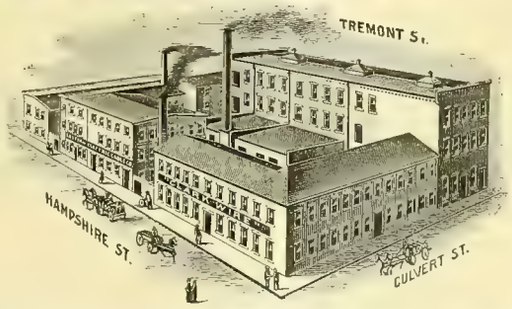


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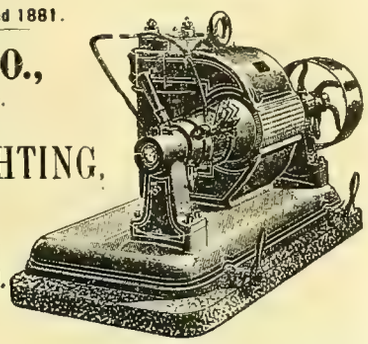

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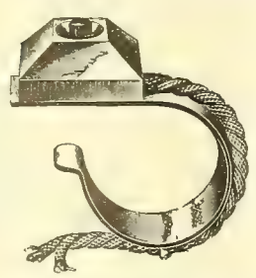

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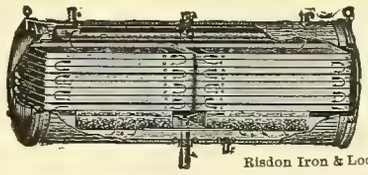

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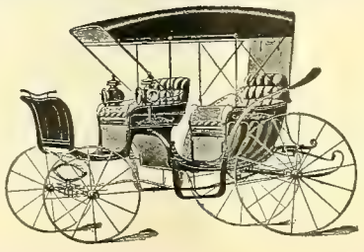

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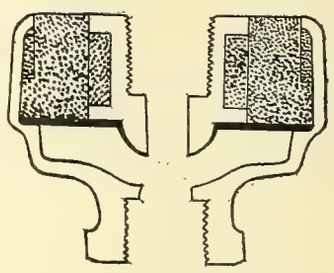

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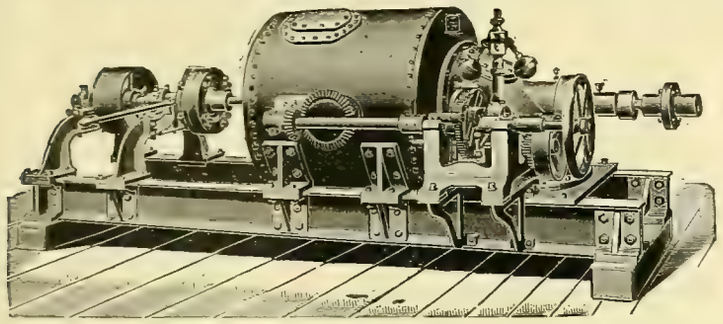

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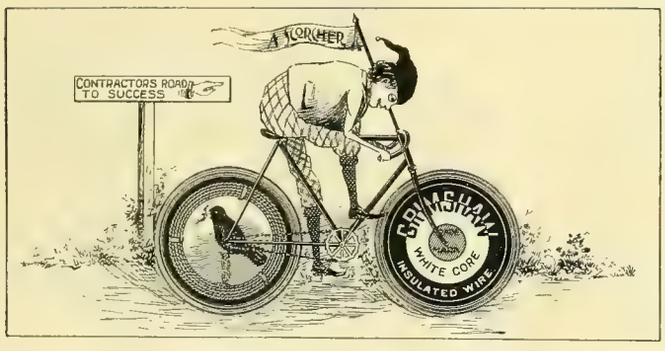


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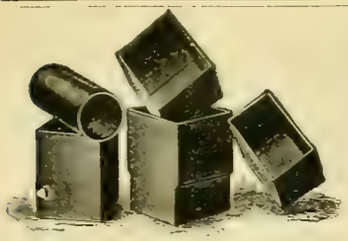

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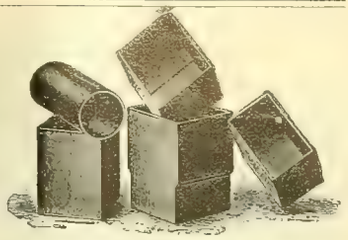

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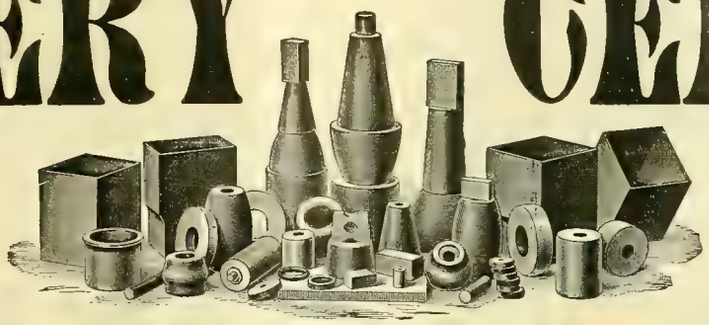

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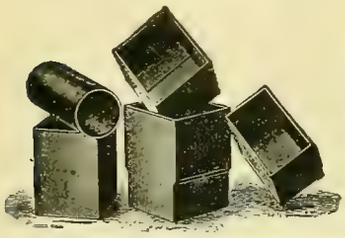

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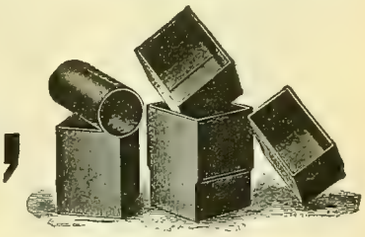

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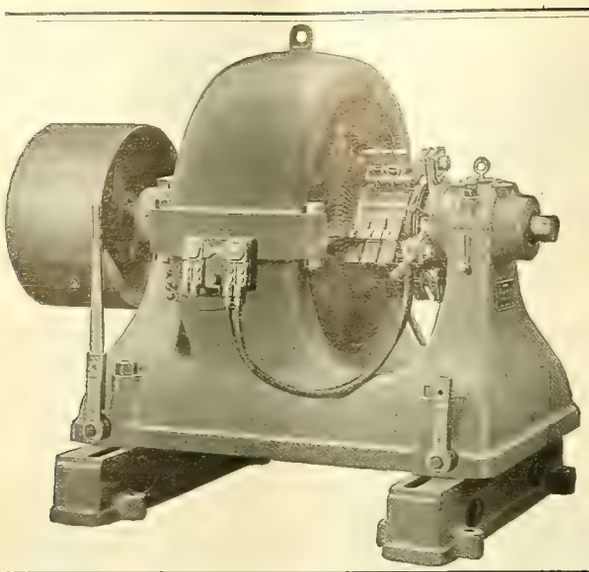

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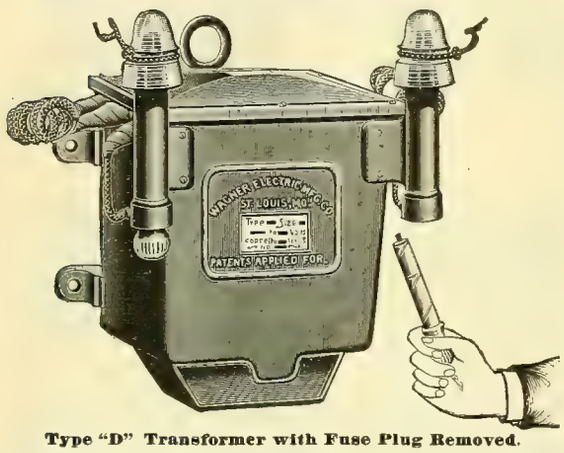


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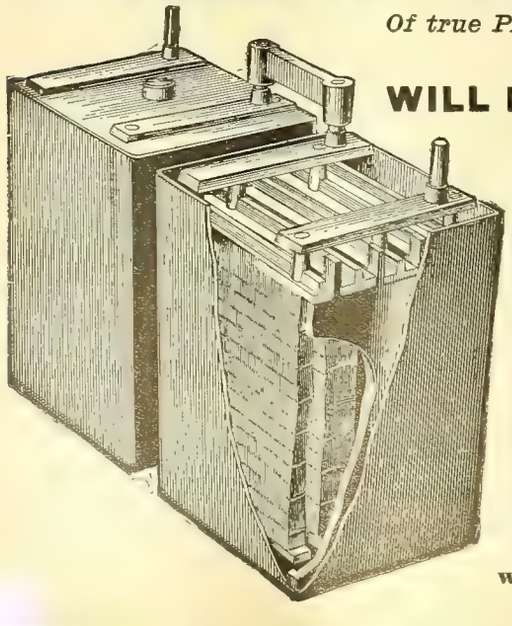

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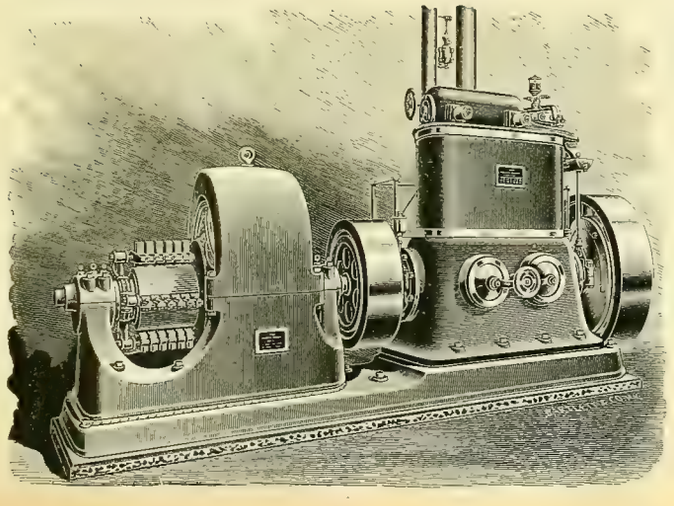

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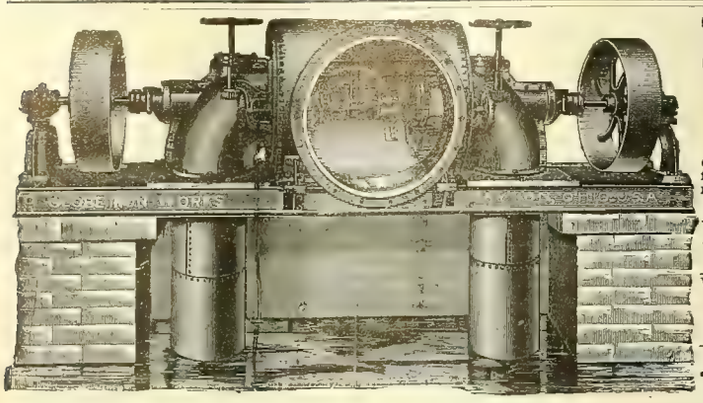

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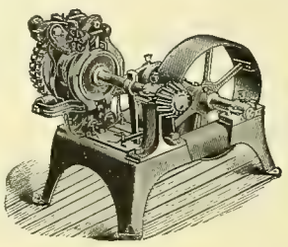

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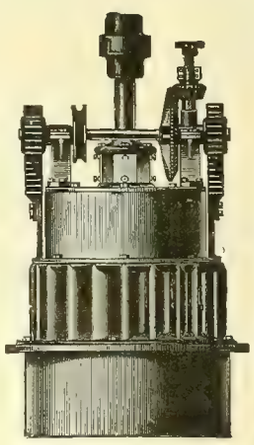

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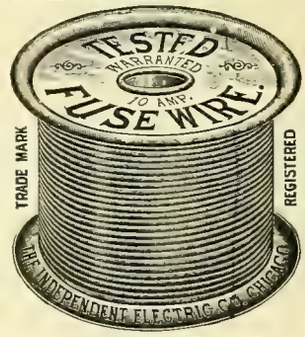


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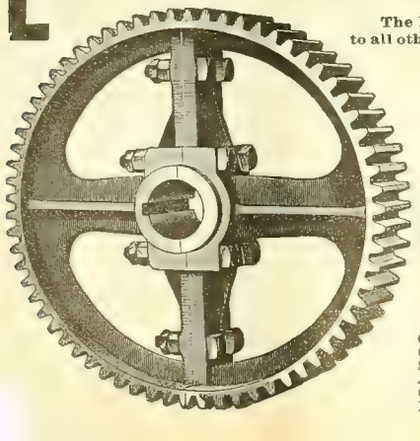

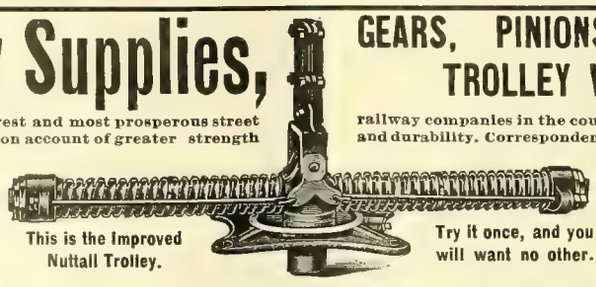

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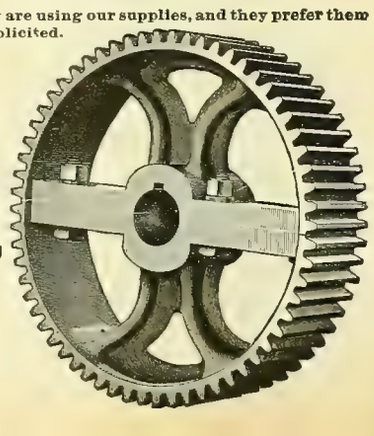

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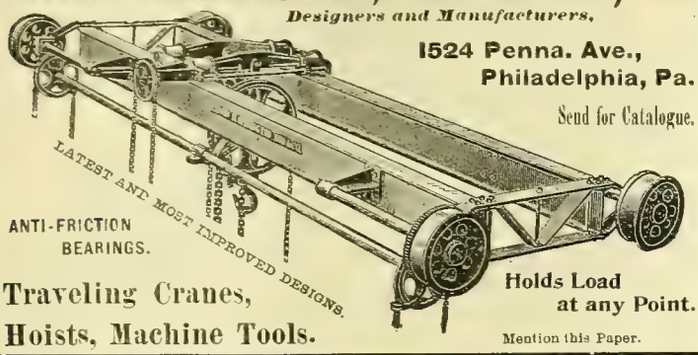


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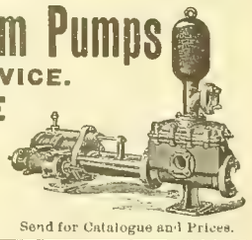

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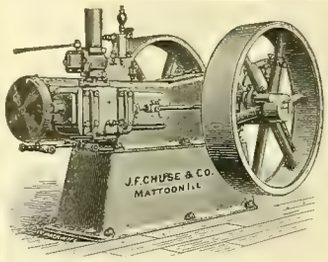


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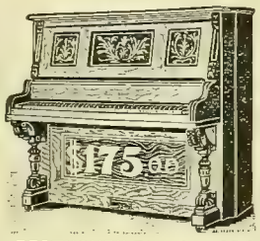

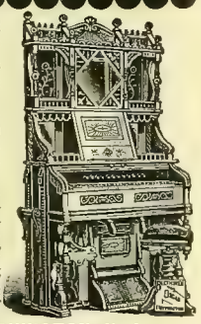

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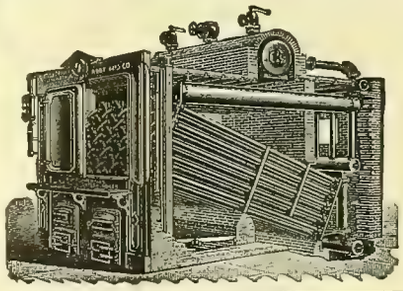

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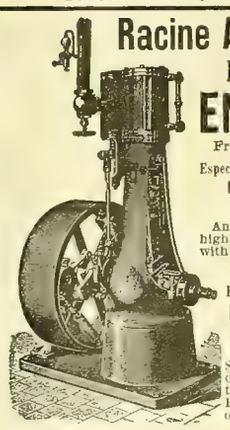

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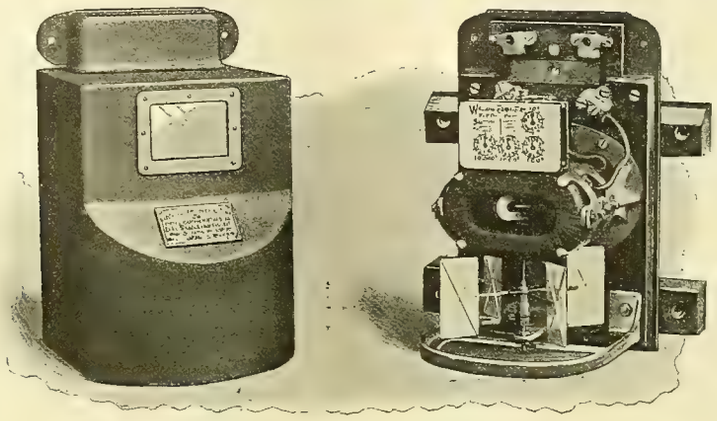

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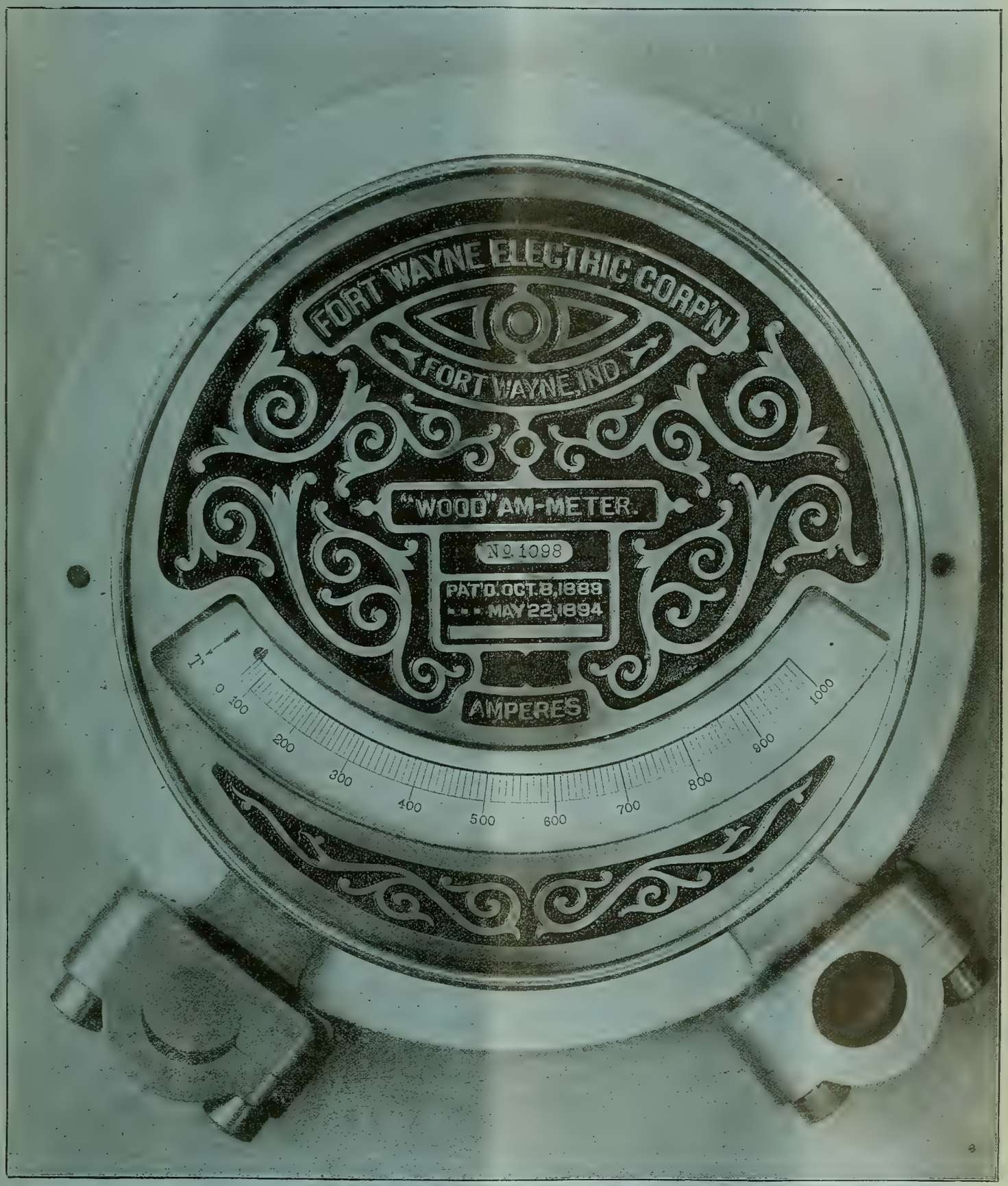


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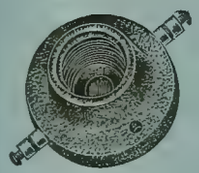

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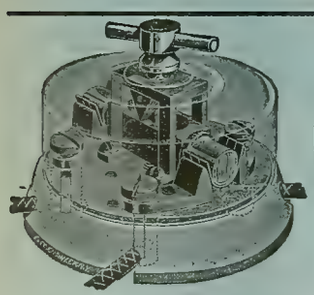

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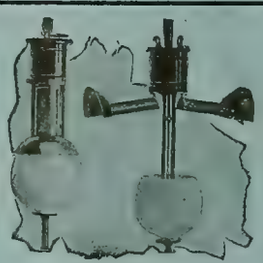

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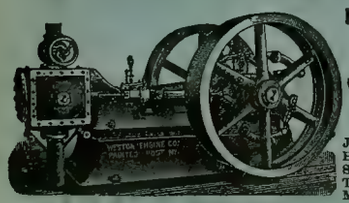

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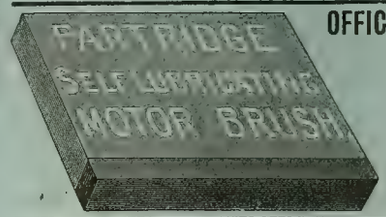
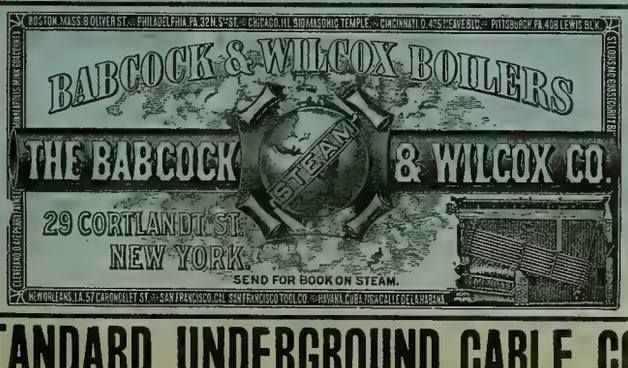



OFFICE AND FACTORY, SANDUSKY, O.

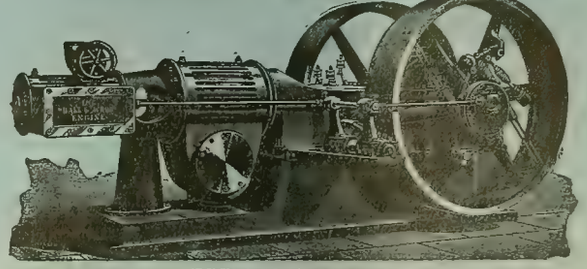
—( AGENTS: )—

C. J. Mayer, Betz Bldg., Philadelphia, Pa.
Smith & Wallace, Hamilton St, Boston, Mass.
Ed. P. Sharp, 44 Niagara St., Buffalo, N. Y.
Arthur S. Partridge, Bank of Commerce Bldg., St. Louis, Mo.
Standard Ry. Supply Co., Monadnock Bldg., Chicago, Ill.
Reger & Atwater, 214 Pine St, San Francisco, California.
Central Electric Co., 173 Adams St., Chicago.
Harry M. Shaw, 126 Liberty St., New York.




**THE BALL & WOOD COMPANY,**

Builders of Improved Automatic Cut-off Engines.



REPRESENTATIVES:

Stern & Silverman, 707 Arch St., Philadelphia, Pa.
George M. Kenyon, Endicott Arcade, St. Paul, Minn.
O. E. Sargent, Fort Dearborn Bldg., Chicago, Ill.
James & Company, Chattanooga, Tenn.

**STANDARD UNDERGROUND CABLE CO.,**

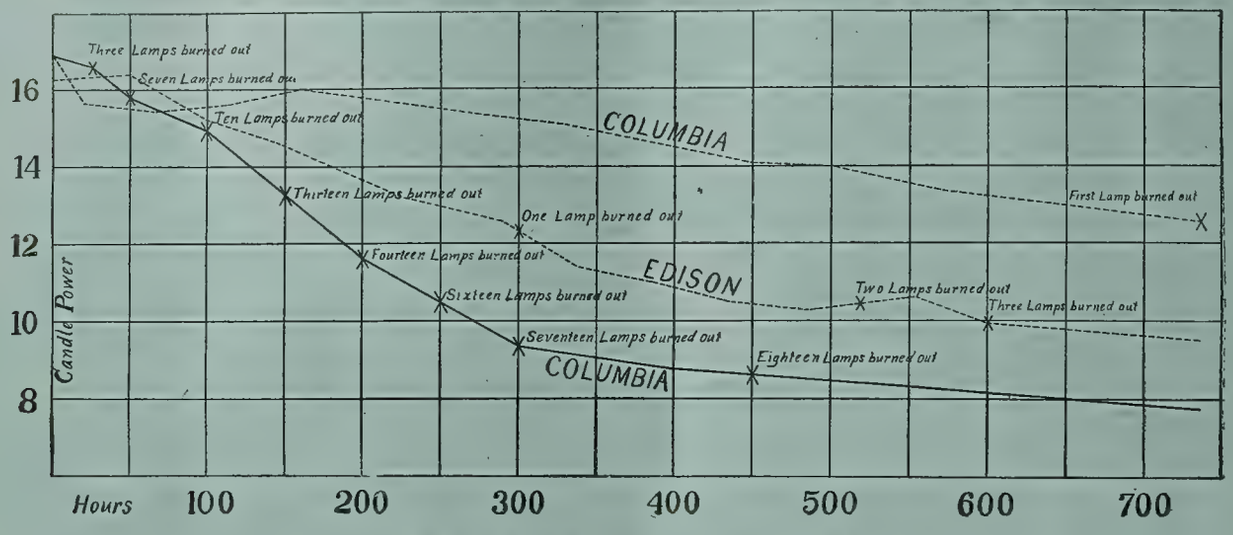
THE ROOKERY, CHICAGO. WESTINGHOUSE BUILDING, PITTSBURG. TIMES BUILDING, NEW YORK.

**WIRES and CABLES,**

Independent Electric Co. Phillips Insulated Wire Co.

# THE TEST BELOW,

Showing curves in broken lines on FOUR Columbia and FIVE Edison lamps, is a copy of curves recently published by the Columbia Company. The lower curve, represented by a continuous line, is the result of a test made by us on THIRTY-FOUR Columbia lamps, starting at an initial economy of 3.1 watt per candle, the voltage being maintained constant throughout their life. The lamps, being taken from sample lots purchased recently in all parts of the country, should show the AVERAGE RESULT which would be obtained from the REGULAR PRODUCT of the Columbia Company.




**NOTE THE DEADLY PARALLEL!!**

In the COLUMBIA COMPANY'S test only 20 per cent. of FIVE Edison lamps had burned out at 300 hours.

In the EDISON COMPANY'S test 50 per cent. of THIRTY-FOUR Columbia lamps had burned out at 300 hours.

The DROP IN CANDLE POWER and CONSEQUENT INCREASE IN WATTS PER CANDLE of the COLUMBIA LAMPS speaks for itself.

To insure the quality of their product, expensive continuous tests are run by the EDISON GENERAL ELECTRIC COMPANY'S LAMP WORKS on each day's product, and also on the product of all companies manufacturing lamps, either in this country or Europe. SIMILAR TESTS ARE A NECESSITY TO MAINTAIN A UNIFORM QUALITY. NEW TYPE EDISON LAMPS purchased in the open market will, at the same voltage and economy, surpass results which can be obtained with any make of incandescent lamps as regards LIFE and HOLDING UP IN CANDLE POWER.

If prices quoted you on NEW TYPE EDISON lamps are not satisfactory, we can furnish at lower prices our "CRESCENT" lamps, which are equal in quality to any lamps in the market.

Our daily output having been largely increased by reason of great increase of orders, until such output is greater than the combined production of all other lamp factories in this country, we are enabled to quote our present low prices for the BEST LAMP WHICH HAS EVER BEEN PRODUCED BY ANY MANUFACTURER.

**NEW TYPE EDISON LAMPS ARE, AND WILL BE MAINTAINED, THE STANDARD OF QUALITY REGARDLESS OF PRICE.**

For information and prices of NEW TYPE EDISON or CRESCENT lamps, address any of our sales offices given below, or Manager Lamp Sales,

# GENERAL ELECTRIC COMPANY,

**HARRISON, N. J.**

**MAIN OFFICE: SCHENECTADY, N. Y.**

**SALES OFFICES:**

Boston, Mass., 180 Summer Street.
New York, N. Y., 44 Broad Street.
Syracuse, N. Y., Sedgwick, Andrews & Kennedy Bldg.
Buffalo, N. Y., Erie County Savings Bank Building.
Philadelphia, Pa., 509 Arch Street.
Baltimore, Md., 227 East German Street.
Pittsburg, Pa., Times Building.

Atlanta, Ga., Equitable Building.
Cincinnati, Ohio, 420 West Fourth Street.
Columbus, Ohio, 14 North High Street.
Nashville, Tenn., 308 North Summer Street.
Chicago, Ill., Monadnock Building.
Detroit, Mich., 13 Rowland Street.
Omaha, Neb., 309 South 13th Street.

Kansas City, Mo., New York Life Building.
St. Louis, Mo., Wainwright Building.
Dallas, Tex., Corner Elm and Griffin Streets.
Helena, Mont., Electric Building.
Denver, Colo., 505 16th St.
San Francisco, Cal., 15 First Street.
Portland, Ore., Front and Ankeny Streets.
Seattle, Washington, Bailey Building.

For all business outside the United States and Canada: Foreign Dept, Schenectady, N. Y. and 44 Broad Street, N. Y.

For Canada, address Canadian General Electric Company, Ltd., Toronto, Canada.

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## CLASSIFIED LIST.

**Accumulators.**
Electric-Power Storage Co.
Electric Storage Battery Co.
Ohio Storage Battery Co.

**Annunciators.**
Central Electric Co.
Chicago Gen'l Fixture Co.
Electric Appliance Co.
Ostrander & Co., W. R.
Partrick & Carter Co.

**Arc Lamps.**
Central Electric Co.
Chicago Gen'l Fixture Co.
Corey, R. B.
Crocker-Wheeler Elec. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Helios Electric Co.
Solar Electric Co.
Standard Electric Co.
Standard Thermometer Co.
Waterman, C. H.
Westinghouse El. & Mfg. Co.

**Arc Light Cord.**
Samson Cordage Wks.

**Batteries and Jars.**
Andrae & Sons, J.
Boynton Multivolt Batt'y Co.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Central Electric Co.
Chicago Gen'l Fixture Co.
Edgerton Pottery Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Hemingray Glass Co.
Leclanche Battery Co., The.
Miamisburg Electric Co
Newton Rubber Wks.
Ohio Storage Battery Co.
Partrick & Carter Co.
Western Electric Co.

**Bells.**
Andrae & Sons, J.
Central Electric Co.
Electric Appliance Co.
Gillette, E. & F.
Huebel & Manger.
Ostrander & Co., W. R.
Partrick & Carter Co
Western Electric Co.

**Belting.**
Shultz Belting Co.

**Boilers.**
Abendroth & Root Mfg. Co.
Babcock & Wilcox Co.. The.
Clonbrock Steam Boiler Co.
Moyes, L. M.
Racine Hardware Co.
Weston Engine Co.

**Books, Electrical.**
Electrician Publishing Co.

**Bronze.**
Besly & Co., Chas. H.
Phosphor Bronze Sm.Co.,Ltd.

**Brushes.**
Belknap Motor Co.
Boudreaux Dyn. Brush Co.
Central Electric Co.
Partridge Carbon Co.

**Burglar Alarms.**
Central Electric Co.
Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

**Cables** (See Insulated Wires.)
**Cables, Electric** (See Insulated Wires), **Copper, Sheet and Bar.**
American Elec. Works.
Brixey, W. R.
Central Electric Co.
Eastern Electric Cable Co.
Elec. Engr. & Supply Co.
Moore, Alfred F.
New York Ins. Wire Co.
Simplex Electrical Co.
Standard Underground C.Co.
Western Electric Co.

**Carbons, Points & Plates.**
Central Electric Co.
Chicago Gen'l Fixture Co.
Corey, R. B.
DeRonde & Co., A.
General Electric Co.
Hardtmuth & Co., F.
Partridge Carbon Co.
Reisinger, Hugo.
Wertheim, Ed.
Western Electric Co.

**Carriages and Buggies.**
Henney Buggy Co.

**Clocks, Watchmen's.**
Southgate & Co., W. B.

**Compound.**
Standard Paint Co.

**Conduits.**
Central Electric Co.
Interior Conduit & Ins. Co.

**Construction & Repairs.**
Crocker-Wheeler Elec. Co.
Ft. Wayne Elec. Corporation.
Royal Electric Co.

**Contractors and Electric Light Plants.**
Arnold, B. J.
Bain, Foree.
Brush Electric Co.
Bryan, Wm. H.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Goltz & Sinclair.
Interior Conduit & Ins. Co.
Royal Electric Co.
Siemens & Halske Elec. Co.
Standard Electric Co.
United Elec Improvement Co
Walkins, Louis E.
Westinghouse Elec & Mfg. Co.
Western Electric Co.

**Copper.**
Besly & Co., Chas. H.
Miamisburg Electric Co.

**Copper Wires.**
American Electrical Works.
Besly & Co., Chas. H.
Brixey, W. R.
Bunnell & Co., J. H.
Central Electric Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.
National India Rubber Co.
Okonite Co. The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Western Electric Co.

**Cordage.**
McEvoy, C. H.
Samson Cordage Wks.

**Cranes.**
Harrington, Son & Co., E.

**Cross-Arms, Pins and Brackets.**
Anderson, Albert & J. M.
Brady, T. H.
Central Electric Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Nuttal Co., R. D.
Partrick & Carter Co.

**Cut-Outs and Switches.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Bryant Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Edison Co.
Chicago Gen'l Fixture Co.
Colgate Co., Geo. L.
Crocker-Wheeler Elec. Co.
Diamond Electric Co.
Eddy Elec. Mfg. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric Protection Co.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Forest City Elec. Wks.
Forsyth & Fisk.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hart & Hegeman Mfg. Co.
Huebel & Manger.
Interior Conduit & Ins. Co.
Louisville Elec. Wks.
Nuttall Co., R. D.
Partrick & Carter Co.
Platt, O. S.
Royal Electric Co.
Solar Electric Co.
Wagner Elec. Mfg. Co.

**Dynamos.**
Brush Electric Co.
Central Electric Co.
Colburn El. Mfg. Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Elliott-Lincoln Elec. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Roth Bros. & Co.
Royal Electric Co.
Siemens & Halske Elec. Co.
Standard Electric Co.
Walker Mfg. Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

**Economizers.**
Fuel Economizer Co.

**Electric Railways.**
Brush Electric Co.
General Electric Co.
Siemens & Halske Elec. Co.
Westinghouse El. & Mfg. Co.

**Electrical and Mechanical Engineers.**
Arnold, B. J.
Bain, Foree.
Bryan, Wm. H
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Goltz & Sinclair.
Thayer Electric Co.
Walkins, Louis E.

**Electrical Instruments.**
Anderson, Albert & J. M.
Bunnell & Co., J. H.
Central Electric Co.
Diamond Electric Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Interior Conduit & Ins. Co.
Nuttall Co., R. D.
Partrick & Carter Co.
Platt, O. S
Queen & Co. Inc.
Southgate & Co., W. B.

**Electrical Specialties.**
Clark El. Specialty Mfg. Co.
Electric Protection Co.
Interstate Com. El. Const Co.
S. K. C. Specialty Co.

**Electroliers, etc.**
Edwards, W. S. Mfg. Co.

**Electro-Plating Mach'y.**
Besly & Co., Chas. H.
Colburn El. Mfg. Co.
General Electric Co.

**Engines, Gas.**
Otto Gas Engine Wks.

**Engines, Steam.**
Ball & Wood Co., The.
Chuse & Co., J. F.
Racine Hardware Co.
Westinghouse Machine Co.
Weston Engine Co.

**Engravers.**
Chic. Electro & Stereo Co.
Illinois Eng. Co.

**Fan Outfits.**
Central Electric Co.
Interior Conduit & Ins. Co.
Roth Bros. & Co.

**Feed Water Heaters.**
Goubert Mfg. Co.

**Fibre.**
Butler Hard Rubber Co.
Vulcanized Fibre Co.

**Fire Alarms.**
Partrick & Carter Co.
Western Electric Co.

**Fuse Wire.**
Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.

**Gas Lighting, Electric.**
Partrick & Carter Co.

**Gears.**
Besly & Co., Chas. H.
Nuttall Co., R. D.

**General Elec. Supplies.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Besly & Co., Chas. H.
Bryant Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Edison Co.
Chicago Gen'l Fixture Co.
Colgate Co., Geo. L.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric Protection Co.
Elliott-Lincoln Elec. Co.
Farr Tel. & Const. Supply Co.
Forest City Elec. Wks.
General Electric Co.
Goltz & Sinclair.
Hayes, Fyfe Co.
Interior Conduit & Ins. Co.
Louisville Elec. Wks.
Metropolitan Electric Co.
Mianus Electric Co.
Morris & MacCurdy.
Partrick & Carter Co.
Platt, O. S.
Queen & Co. Inc.
Sioux City Brass Works.
S. K. C. Specialty Co.
Solar Electric Co.
Standard Tel. & Elec. Co.
Thayer Electric Co.

**Globes and Electrical Glassware.**
Edgerton Pottery Co.
Edwards, W. S. Mfg. Co.
Hemingray Glass Co.

**Graphite Specialties.**
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.

**Hard Rubber Goods.**
Butler Hard Rubber Co.
Fiberite Co.. The.
Newton Rubber Wks.

**Insulators and Insulating Materials.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Brixey, W. R.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Central Electric Co.
Crocker-Wheeler Elec. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Empire China Works.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Hart & Hegeman Mfg. Co.
Hemingray Glass Co.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Louisville Elec. Wks.
Munsell & Co., Eugene.
National India Rubber Co.
Newton Rubber Wks.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Platt, O. S.
Simplex Electrical Co.
Standard Paint Co.
Standard Underground C.Co.

**Insulated Wires and Cables—Magnet Wire.**
American Electrical Works.
Brixey, W. R.
Bunnell & Co., J. H.
Central Electric Co.
Eastern Electric Cable Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
General Electric Co.
Independent Electric Co.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C.Co.

**Lamps, Incandescent.**
Am. Electrical Mfg. Co.
Buckeye Electric Co.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Globe Electric Light Co.
New York & Ohio Co.
Partrick & Carter Co.
United Elec. Imp. Co.
Westinghouse Elec. & Mfg Co.

**Lightning Arresters.**
Colgate Co., Geo. L.
Diamond Electric Co.
Electric Appliance Co.
General Electric Co.

**Magnet Wire.**
(See Insulated Wires.)

**Mechanical Machinery**
Besly & Co., Chas. H.
Harrington, Son & Co., E.
Lukens Iron & Steel Co.
Manistee Iron Wks. Co.

**Mica.**
Johns Mfg. Co., H. W.
Munsell & Co. Eugene.

**Mining Apparatus, Elec.**
General Electric Co.
Independent Electric Co.

**Motors.**
Andrae & Sons, J.
Belknap Motor Co.
Brush Electric Co.
Central Electric Co.
Colburn El. Mfg. Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Elec. Engr. & Supply Co.
Elliott-Lincoln Elec. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Roth Bros. & Co.
Royal Electric Co.
Sioux City Brass Works.
Standard Electric Co.
Stanley Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
Walker Mfg. Co.
Westinghouse El. & Mfg Co.

**Packing.**
Besly & Co., Chas. H.
Garlock Packing Co.

**Paints.**
Morris & MacCurdy.
Standard Paint Co.

**Patents.**
Gooch, Chas. J.

**Phosphor Bronze.**
Phosphor Bronze Sm.Co. Ltd

**Pianos and Organs.**
Beethoven Piano & Organ Co

**Platinum.**
Baker & Co.

**Poles.**
Morris, Tasker & Co.
Nuttall Co., R. D.
Valentine-Clark Co.

**Porcelain.**
Empire China Works.
General Electric Co.
Hemingray Glass Co.

**Publishers, Electrical.**
Electrician Publishing Co.

**Pumps.**
Manistee Iron Wks. Co.

**Push Buttons.**
Central Electric Co.
Electric Appliance Co
Partri & Carter Co.

**Rheostats.**
Central Electric Co.
General Electric Co.
Hayes, Fyfe Co.
Royal Electr c Co,

**Sal Ammoniac.**
Klipstein & Co., A.

**Silk Braid.**
Boston Braid Mfg. Co.

**Speaking Tubes.**
Central Electric Co.
Electric Appliance Co.
Ostrander & Co., W. R
Partrick & Carter Co.

**Speed Indicators**
Besly & Co., Chas. H.
Colgate Co., Geo. L.
Diamond Electric Co.
Queen & Co. Inc.

**Steam Heating.**
Goubert Mfg. Co.
Webster & Co., Warren.

**Storage Batteries.**
Electric-Power Storage Co.
Electric Storage Battery Co.
Ohio Storage Battery Co.

**Street Cars.**
Brill, J. G. Co.

**Tapes, Insulating.**
American Electrical Works.
Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
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Okonite Co., The.
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Mo. Telephone Mfg. Co.
Partrick & Carter Co.
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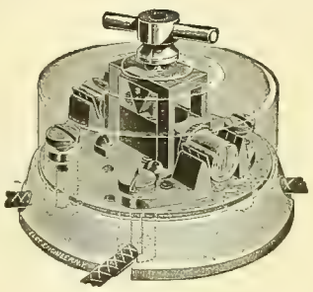

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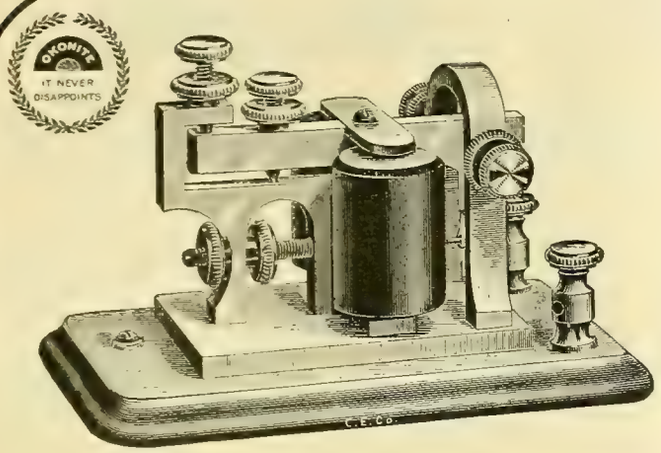


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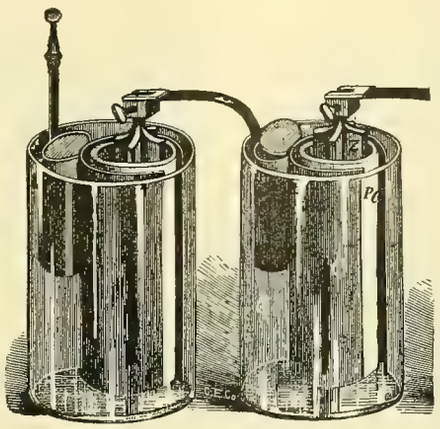

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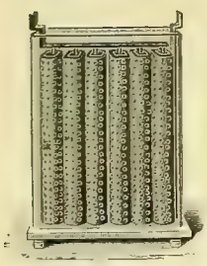

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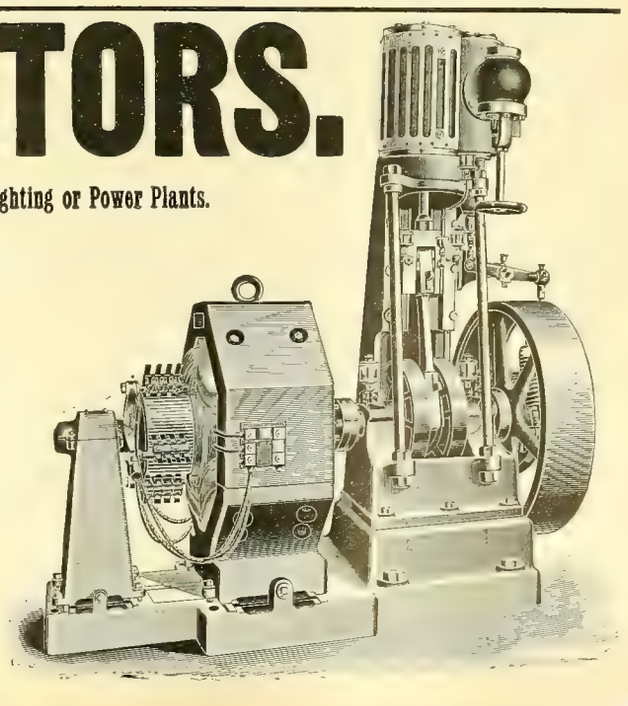

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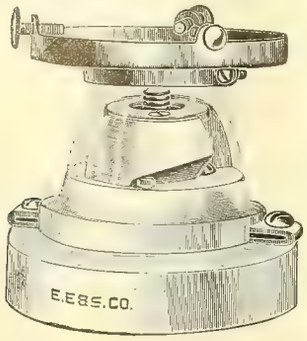


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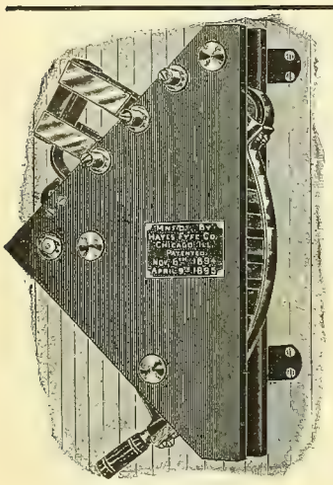

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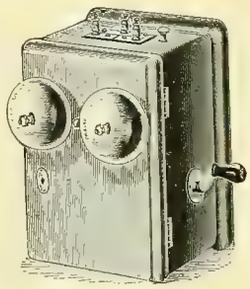

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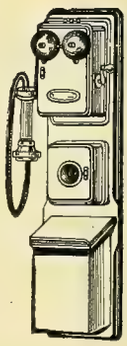

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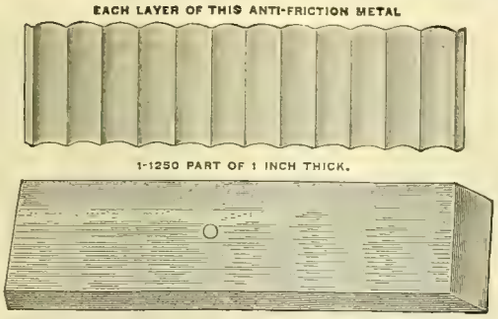


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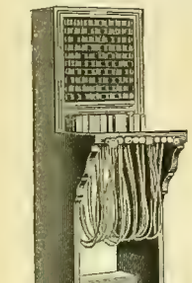

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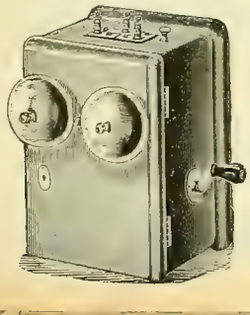

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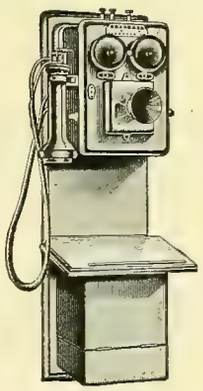

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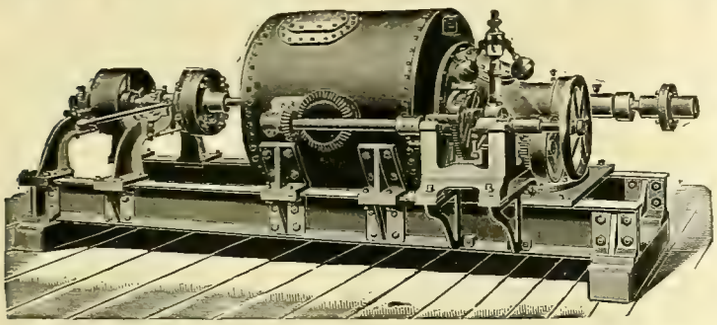

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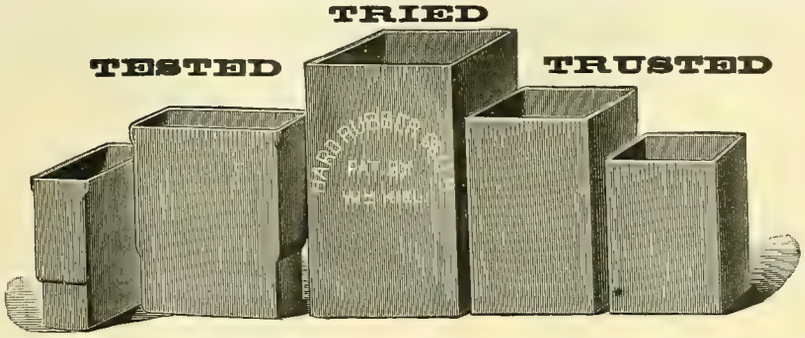

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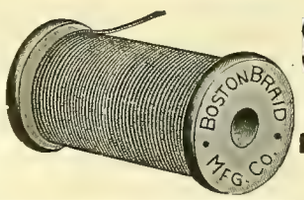


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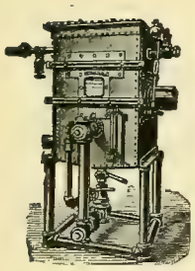

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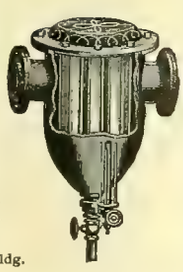

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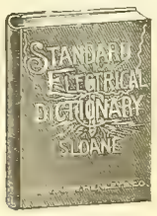

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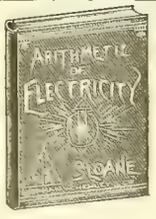

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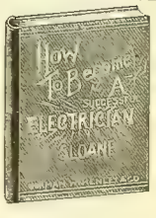

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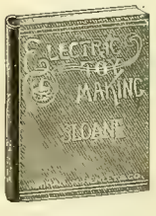

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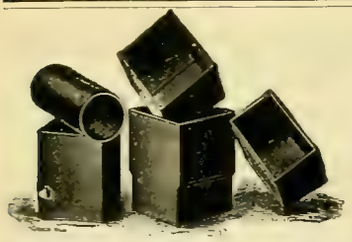

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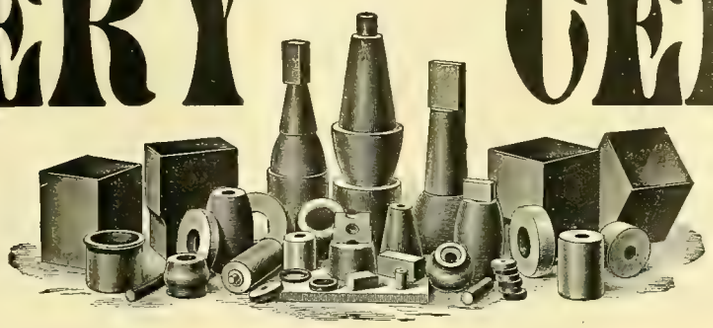

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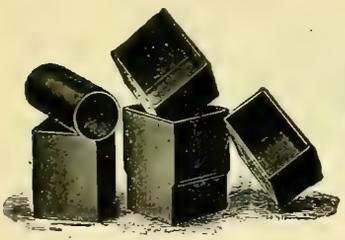

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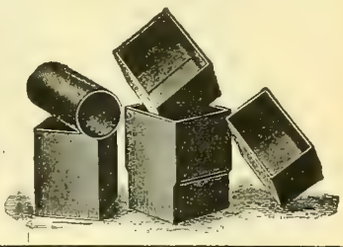

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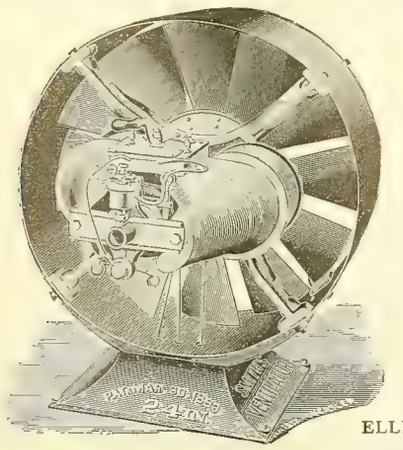

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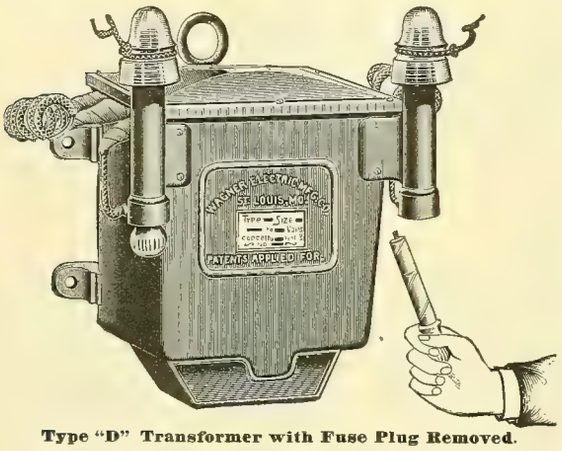


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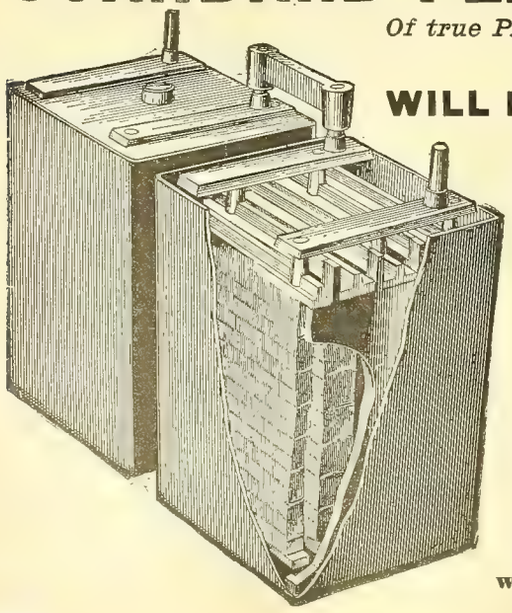

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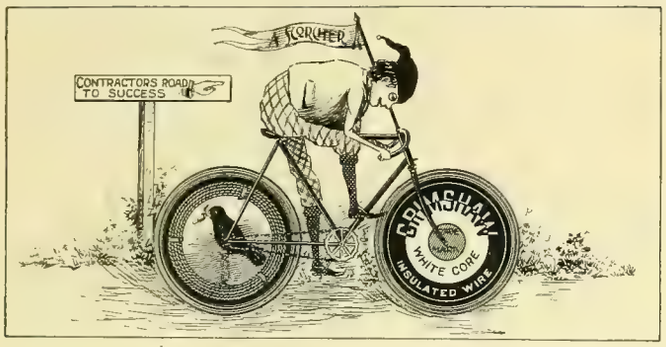


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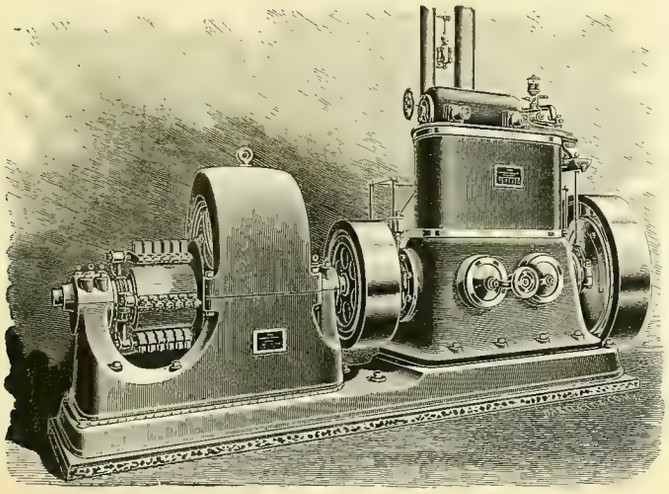

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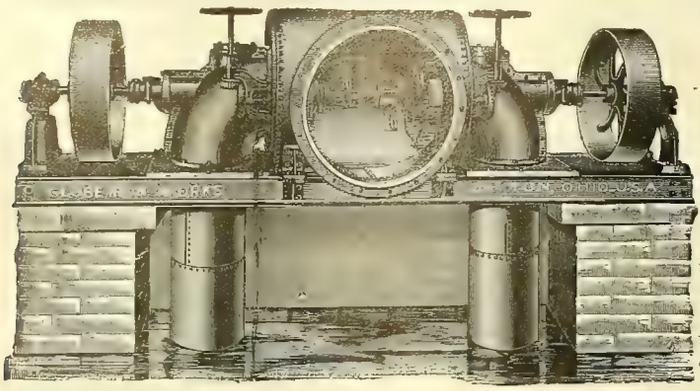

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| ⅞ " | 16.42 | 122.00 | 127.18 | 195.19 | 82.58 |
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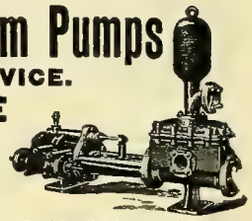

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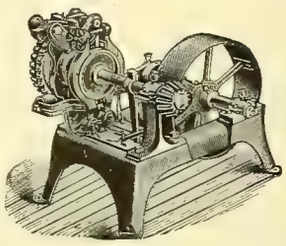

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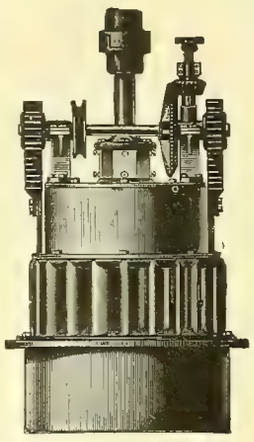

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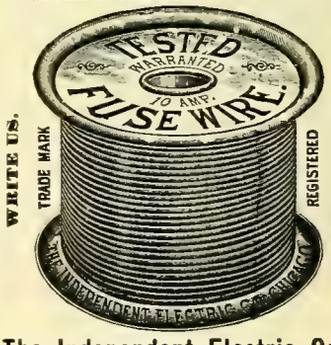


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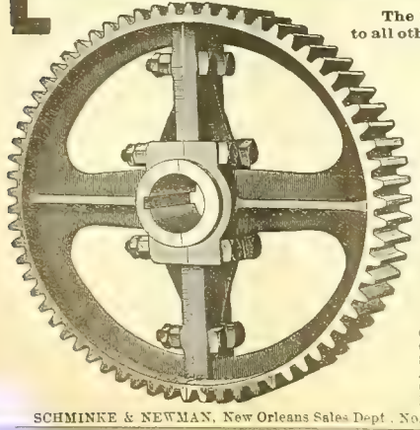

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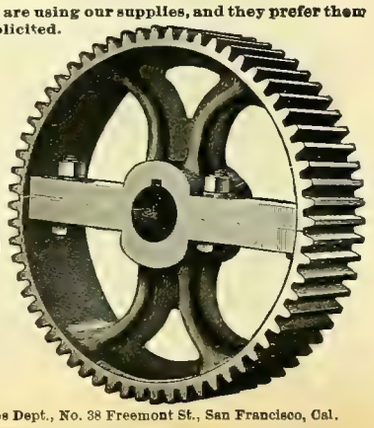

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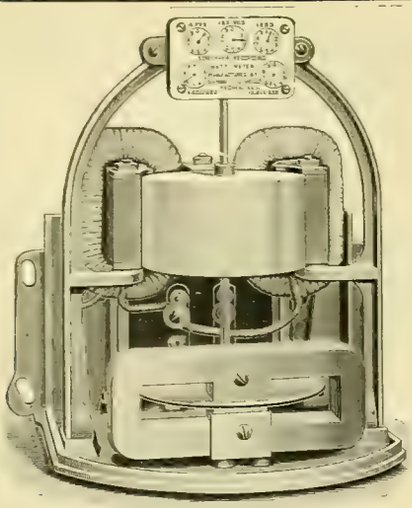

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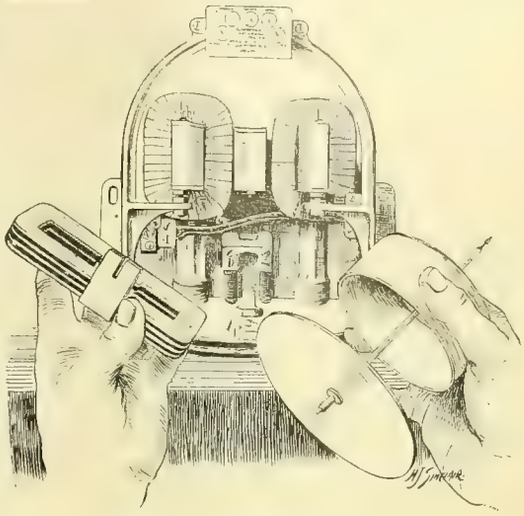

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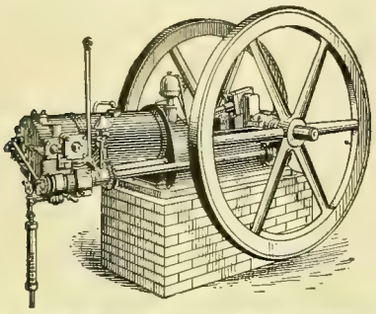

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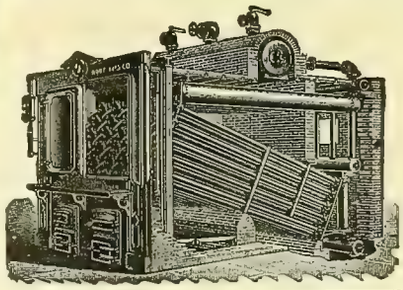

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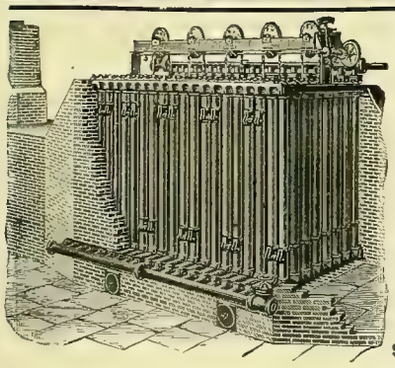

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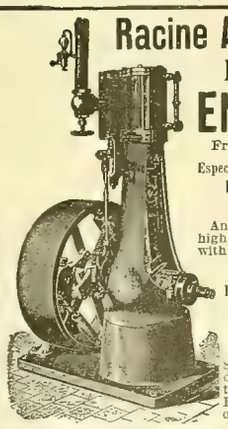

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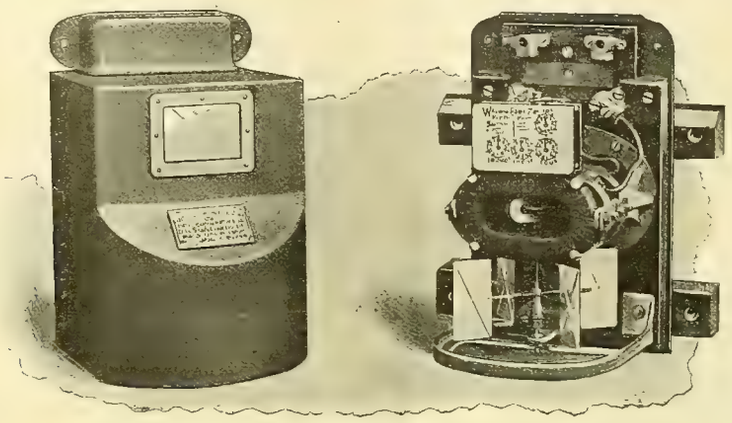

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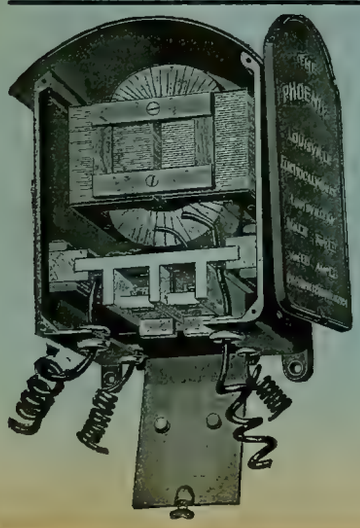

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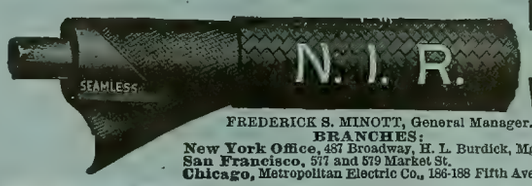


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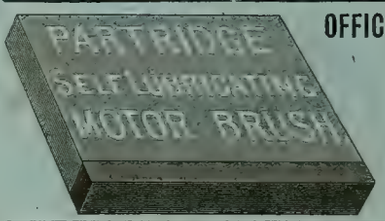


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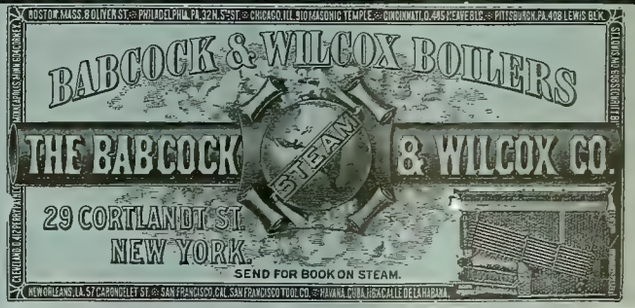


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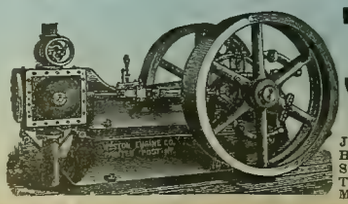

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Standard Electric Co.
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Phillips Insulated Wire Co.
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Western Electric Co.

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Elec. Engr. & Supply Co.
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Farr Tel. & Const. Supply Co.
Fiberite Co., The.
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Chicago Gen'l Fixture Co.
Colgate Co., Geo. L.
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Phillips Insulated Wire Co.
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Electric Appliance Co.
General Electric Co.

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(See Insulated Wires.)

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Standard Electric Co.
Stanley Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
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Garlock Packing Co.

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Standard Paint Co.

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Colgate Co., Geo. L.
Diamond Electric Co.
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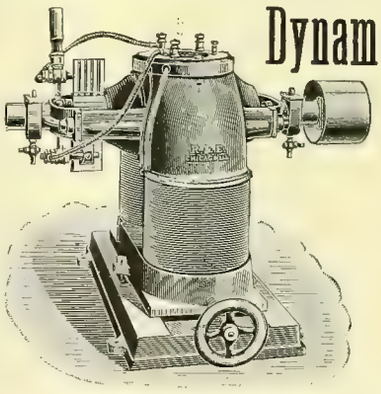

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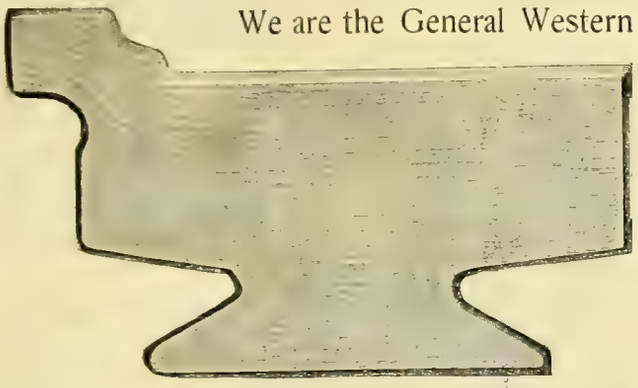

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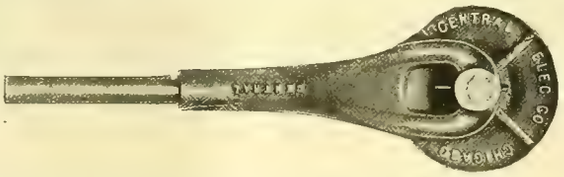


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### This Was A Good One.

"Did I tell you the latest bright thing my little boy got off?" asked McBride, as he joined a group of friends at the club.

"Yes, you did," replied all, in concert with discouraging unanimity.

"That's where I've caught you," retorted McBride, "for it only happened last evening, and I haven't seen a soul of you fellows since. Besides this was really a good one."

"Then you haven't told it to us," replied Kilduff, speaking for the crowd. "Go on."

"Yes, tell us quickly," added Skidmore, "and let us have the agony over."

Thus encouraged, McBride began: "You know, boys, little people have sharp ears, and they are not at all backward about telling any little scraps of information they pick up. This peculiarity has led a good many parents to resort to spelling words when their young children are present. Of course that sort of thing is of no avail after the youngsters learn to spell. Well, Mrs. McBride and I are in the spelling stage now, and little Freddy is often very much mystified by our remarks to each other. Last night we had our new minister to dinner, and Freddy watched the good man helping himself very liberally to biscuits. He thought it a good opportunity to put into use the family verbal cipher, feeling perfectly certain that the minister would find it unintelligible. So he called out, 'Mamma!'

"'What is it, Freddy?' asked my wife.

"'Mamma, isn't the m-i-n-i-s-t-e-r a p-i-g?' spelled out Freddy, triumphantly."

The fellows had to admit that this story about McBride's boy was really a good one.

William Henry Siviter.

Workingmen not only have the sensitiveness of other people about their personal integrity, but sometimes may have a neat way of replying to an imputation upon it.

A carpenter, sent to make some repairs in a private house, entered the apartment of the lady of the house with his apprentice.

"Mary," the lady called to her servant, "see that my jewel case is locked at once!"

The carpenter understood. He removed his watch and chain from his vest with a significant air, and gave them to his apprentice.

"John," he said, "take these right back to the shop. It seems that the house isn't safe!"—Youth's Companion.

The following story is told on Lee Fairchild. At the time the incident occurred Fairchild was holding an editorial position on The West Shore, and was known as the "humorous editor." While writing in the business office one day a stranger entered and inquired if the proprietor was in.

"Yes, sir," replied Fairchild.

"Are you the gentleman?" continued the stranger.

"Yes, sir, but the proprietor is in the other room," answered Fairchild.

When Mr. Samuels, the proprietor, learned of the distinction the young man had drawn between himself and his employer, he discharged him, with the statement.:

"You vos too funny."—San Francisco Post.

### Not The Same.

A neat example of the retort admonitive was recently made by a young Colorado mining engineer, whom we will call Morton, principally because that is not at all like his name. Seated in a chair in a Denver barber shop, undergoing a shave at the hands of a favorite barber, who, although an excellent craftsman, sometimes committed the mistake of becoming too familiar in conversation, the talk turned on the case of a man who, being on trial for murder, had been recognized by visitors to the court room as a young theological student from a Middle state, where he had been the possessor of a spotless reputation and a totally different name. The conversation thereupon drifted to the subject of changed identities.

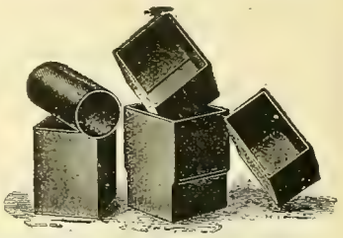
Morton's barber rubbed the razor on the strop reflectively, and said: "Yes, it's surprising how many men change their names after they get out West. By-the-way, Morton, what was your name back East?"

"Mister Morton," was the quiet reply.—Harper's Monthly.

Johnny: Papa, what do people mean when they talk about your constituents?

Mr. Jenkins, M. C.: A constituent, Johnny, is a man who expects you to get him a job.—Judge.

# THE FREEMAN



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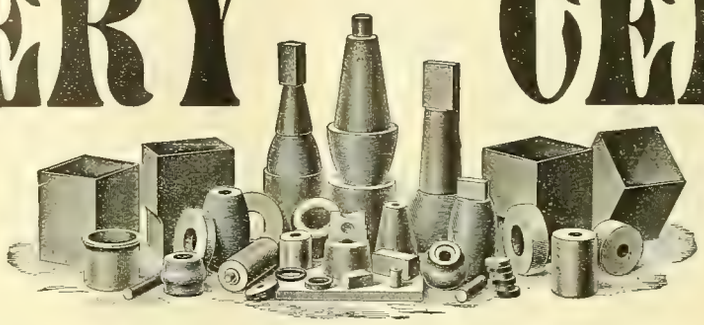

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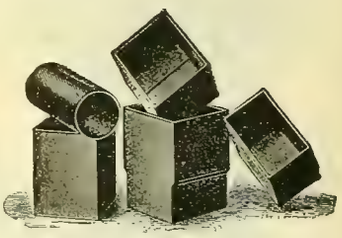

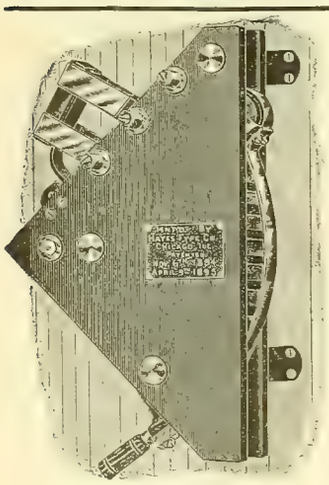

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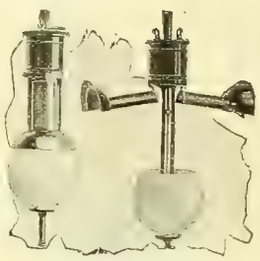

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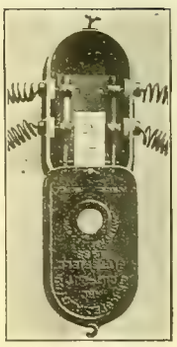

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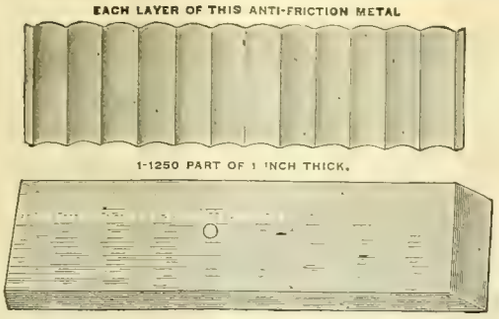

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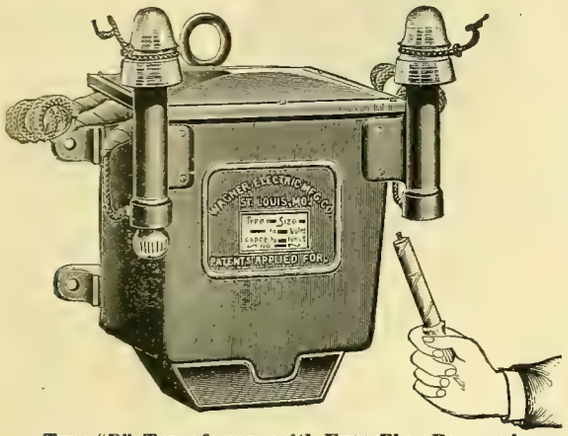


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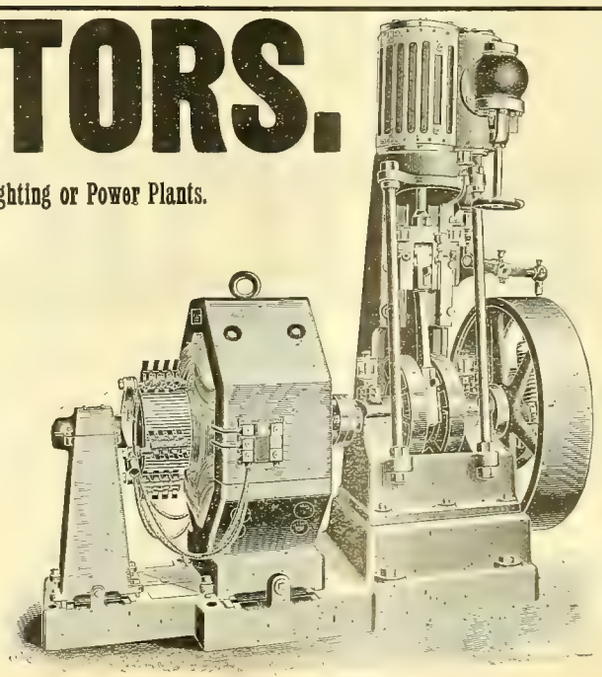

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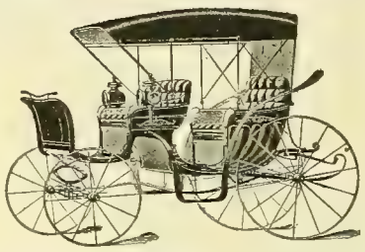

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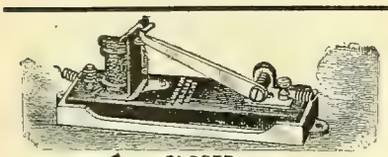

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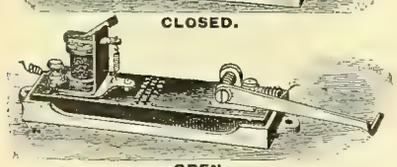

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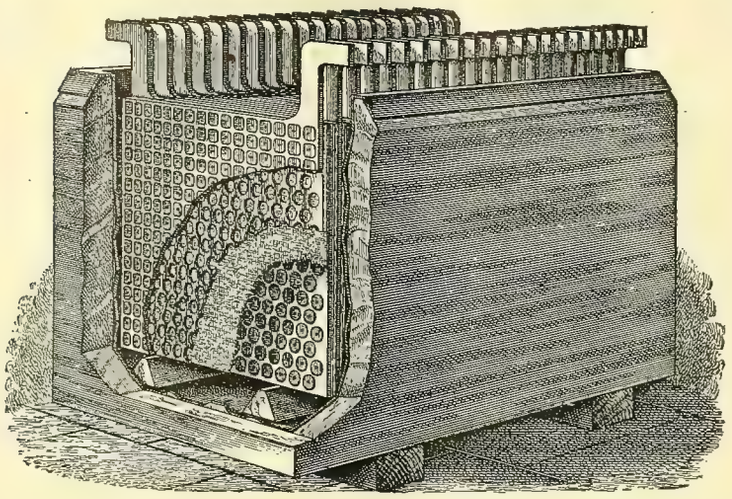

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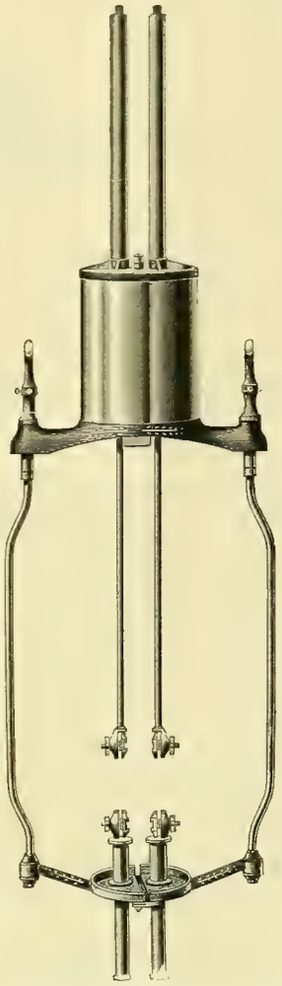

# DOUBLE CARBON LAMPS.

## Important Patent Decision.

From the year 1885 to late in 1890, the Western Electric Company sold double carbon lamps made under a patent of Mr. C. E. Scribner (No. 418,758 of January 7, 1890.)

A feature of this lamp was the simultaneous lifting of both the upper carbons when the current was turned on, after which first one carbon was fed down and consumed and then the other. As a double carbon lamp the Scribner lamp was much liked by many users. In fact, it is considered by many to be by far the best double carbon lamp ever produced. It is still in extensive use.

The Brush Electric Company of Cleveland set up the claim that this lamp was an infringement of a patent of theirs, and a suit was brought in Toledo against a user of the lamps in 1887, which suit was decided at Toledo in 1890 adversely to the user. The lamps which were involved in this suit were at once changed to a non-infringing type satisfactory to the judge who heard the Toledo case, and we discontinued the manufacture and sale of the earlier form of double lamp.

The suit at Toledo having been against a customer of ours, and not against ourselves (although we conducted the defense of that suit), the decision at Toledo was followed by a suit in Chicago against the Western Electric Company. A considerable amount of testimony, additional to that introduced at Toledo, was put into the Chicago case by us.

In the meantime we placed upon the market two new forms of double lamps in which the lamps themselves were double, as distinguished from double ***carbon*** lamps. In a double ***carbon*** lamp like the Brush Company's lamp and our first Scribner lamp, there is one lamp mechanism controlling two pairs of carbons. These two new types of double lamps were named the Monitor lamp and the Duplex lamp. Each consisted of two complete single lamps in one case or frame, one burning its carbons after the other.

Even these were claimed by the Brush Company to be infringements, and a separate suit was brought at Chicago to determine the question. But inasmuch as this was a new question of infringement, no injunction was granted pending a final hearing, and we have continued to supply those double lamps.

The two suits mentioned above as having been brought in Chicago against the Western Electric Company came to a final hearing last Spring, and a decision has just been filed by Judge Showalter dismissing both bills and holding that the patent sued on is limited to a construction where upon turning on the current one of the carbons is lifted after the other, or where the lifting is, in the language of the patent itself, "dissimultaneous." The injunction which has been in force pending a final hearing of the case on our double carbon lamp is of course terminated. Any of our older customers who have lamps of that pattern, and who desire more of them, can now have their orders filled.

Double carbon lamps for low tension or for high tension circuits will be made according to the earlier and favorite plan in which the current lifts both upper carbons at once and then feeds one down so as to consume it before the other burns at all.

Before putting our first double carbon lamp upon the market we made a careful study of the existing patents and did not think that any question of infringement could be raised against it.

It is gratifying to us after a long course of litigation to have our position so fully sustained as it is in the lucid and common-sense opinion filed on the 24th of July by Judge Showalter. The double carbon lamp patent of the Brush Company will expire September 2, 1896.

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Have you had our prices recently on

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Let us figure with you on your next order for rubber covered wire. It will

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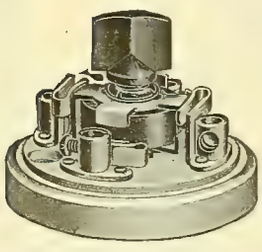

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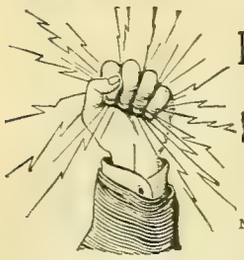

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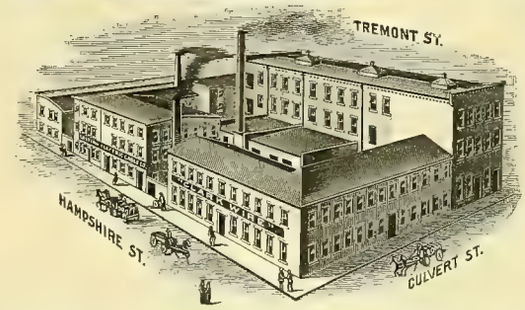


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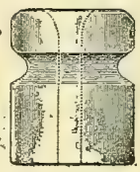

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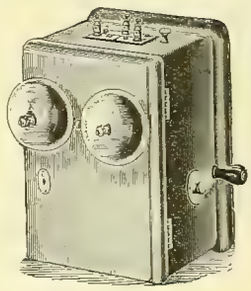

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Each proposal must contain the full name of the party or parties making the same, and all persons interested therein, and must be accompanied by a bond of two thousand ($2,000) dollars of some disinterested person or persons, resident of Cuyahoga county, or a certified check on a solvent bank in the city, as surety that if the proposal be accepted a contract will be entered into.

The city reserves the right to reject any or all bids.

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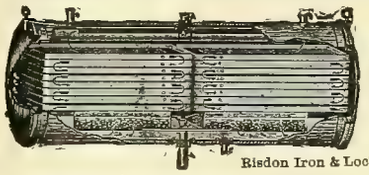

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## Table Push.

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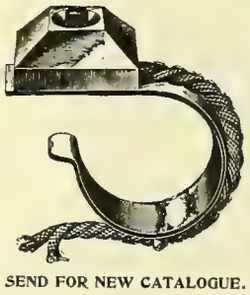

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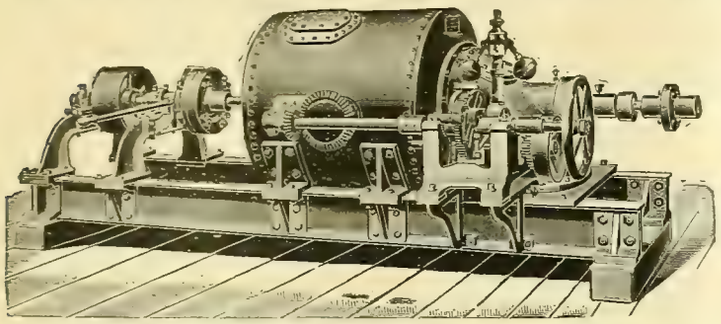

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CONTENTS.

Chapter I. The Absolute System of Measurement.—Chapter II. Electro-Magnetic Induction.—Chapter III. Classification of Machines and General Principles of the Magnetic Circuit.—Chapter IV. The Dynamo as a Motor.—Chapter V. Calculations Pertaining to the Magnetic Circuit.—Chapter VI. Theory of Windings, Losses, etc —Chapter VII. The Dynamo Considered as a Motor.—Chapter VIII. Design of Armatures.—Chapter IX. Design of field-magnets.—Chapter X. Design of Motors.—Chapter XI. Dynamo and Motor Testing.—Chapter XII. Efficiency Tests.—Chapter XIII.—Indicator Diagrams.—Chapter XIV. Steam-Engine Calculations.—Appendix I. Tests of Iron.—Appendix II. Ampere Turntables.—Appendix III. Determination of Sizes of Wire for Armatures and Field Coils.—Appendix IV. Belting.

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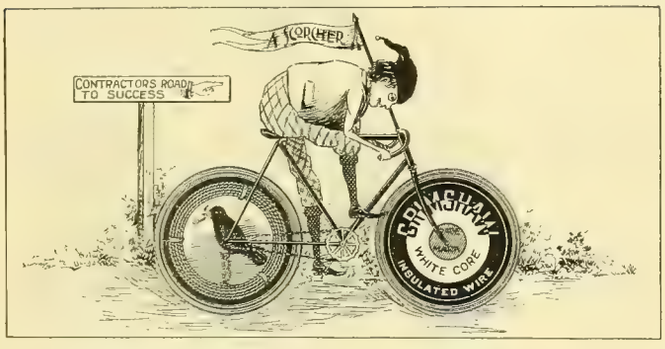


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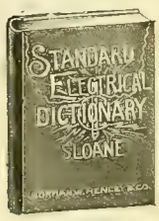


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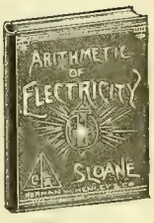


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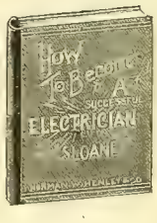


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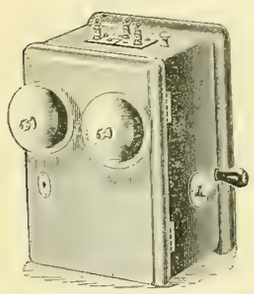

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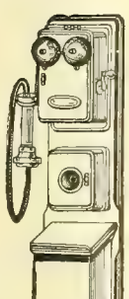

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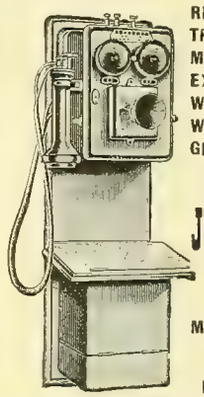

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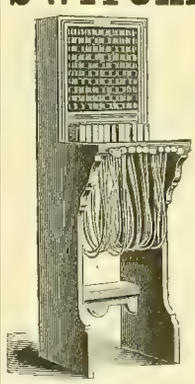

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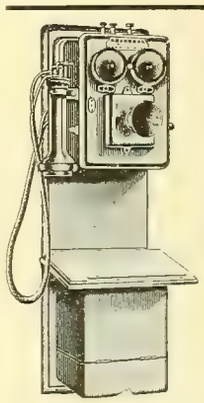

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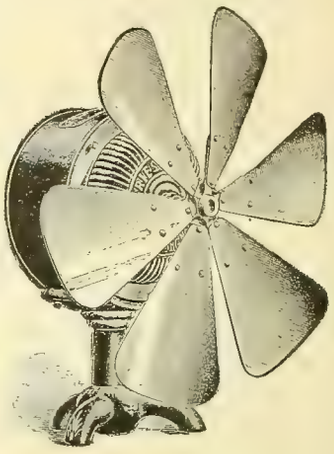

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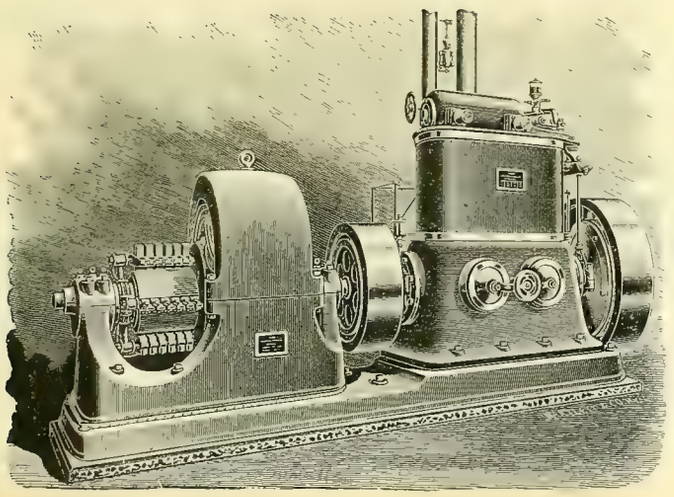

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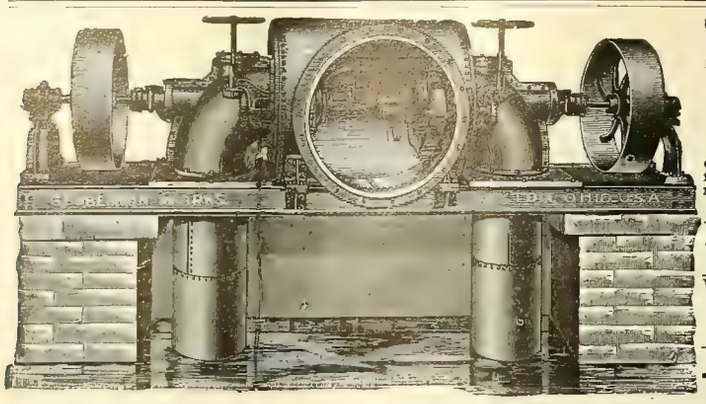

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|---|---|---|---|---|---|
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| ⅞ " | 16.42 | 122.00 | 127.18 | 195.19 | 82.58 |
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| | Head. | Rev. per Min. | Cu. Ft. per Sec. | Horse Power. | P'r Cent |
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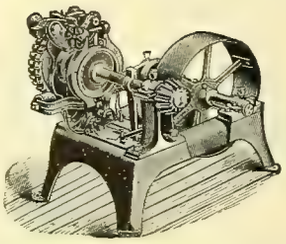

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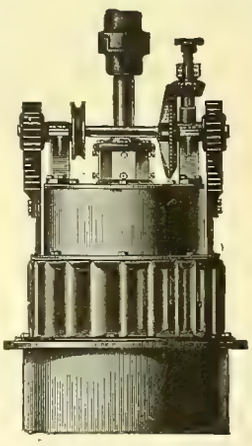

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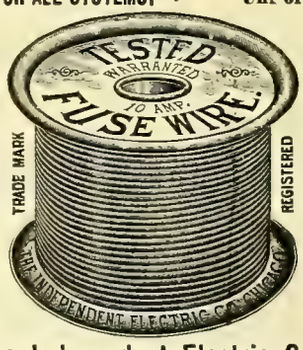


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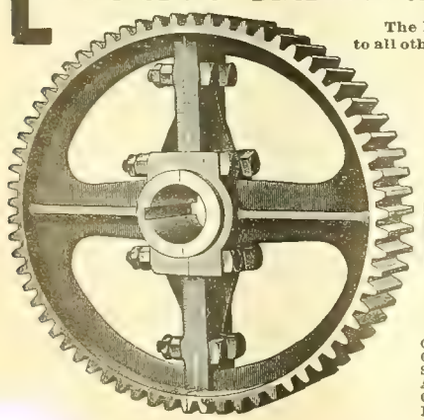

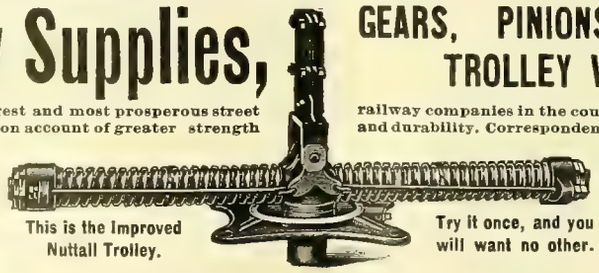

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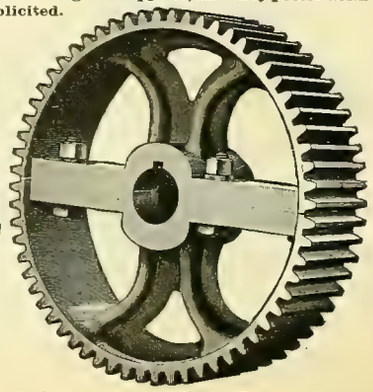

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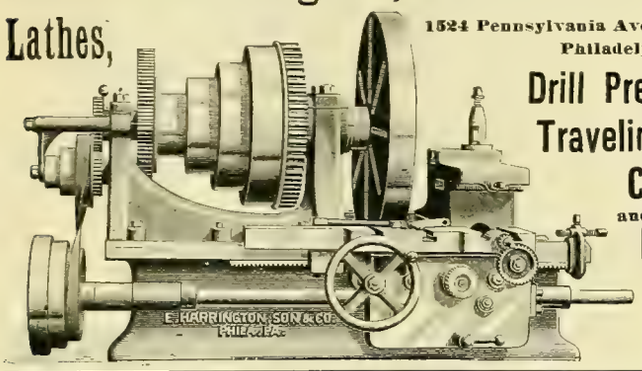


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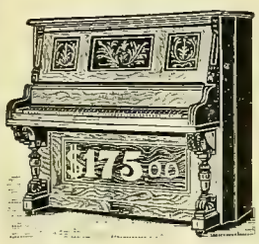


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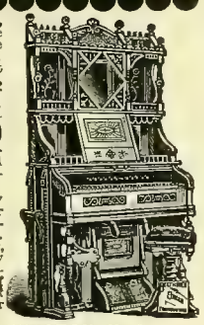

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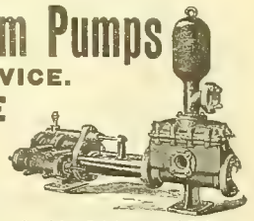

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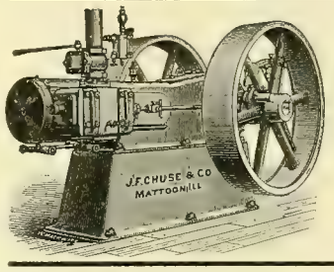


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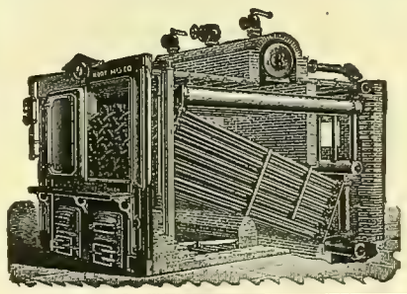

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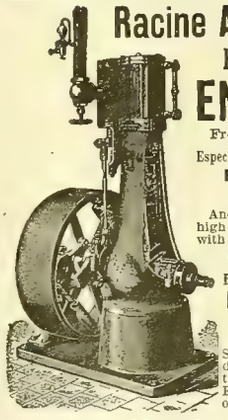

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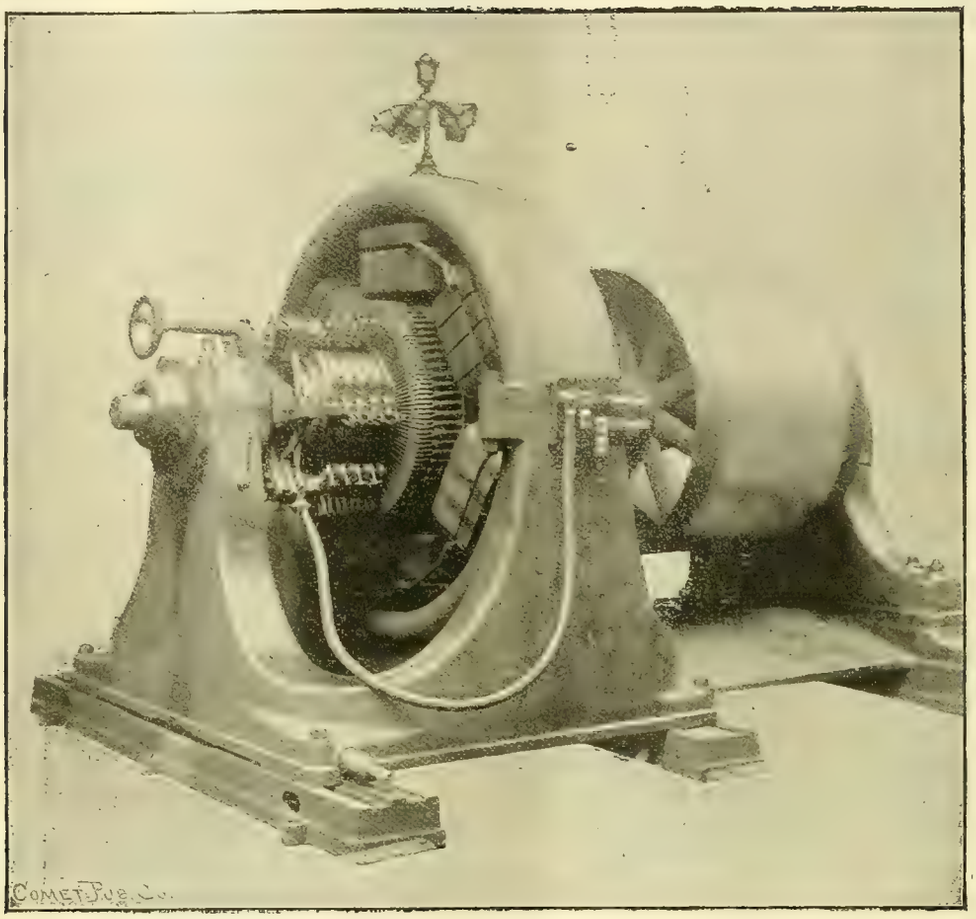

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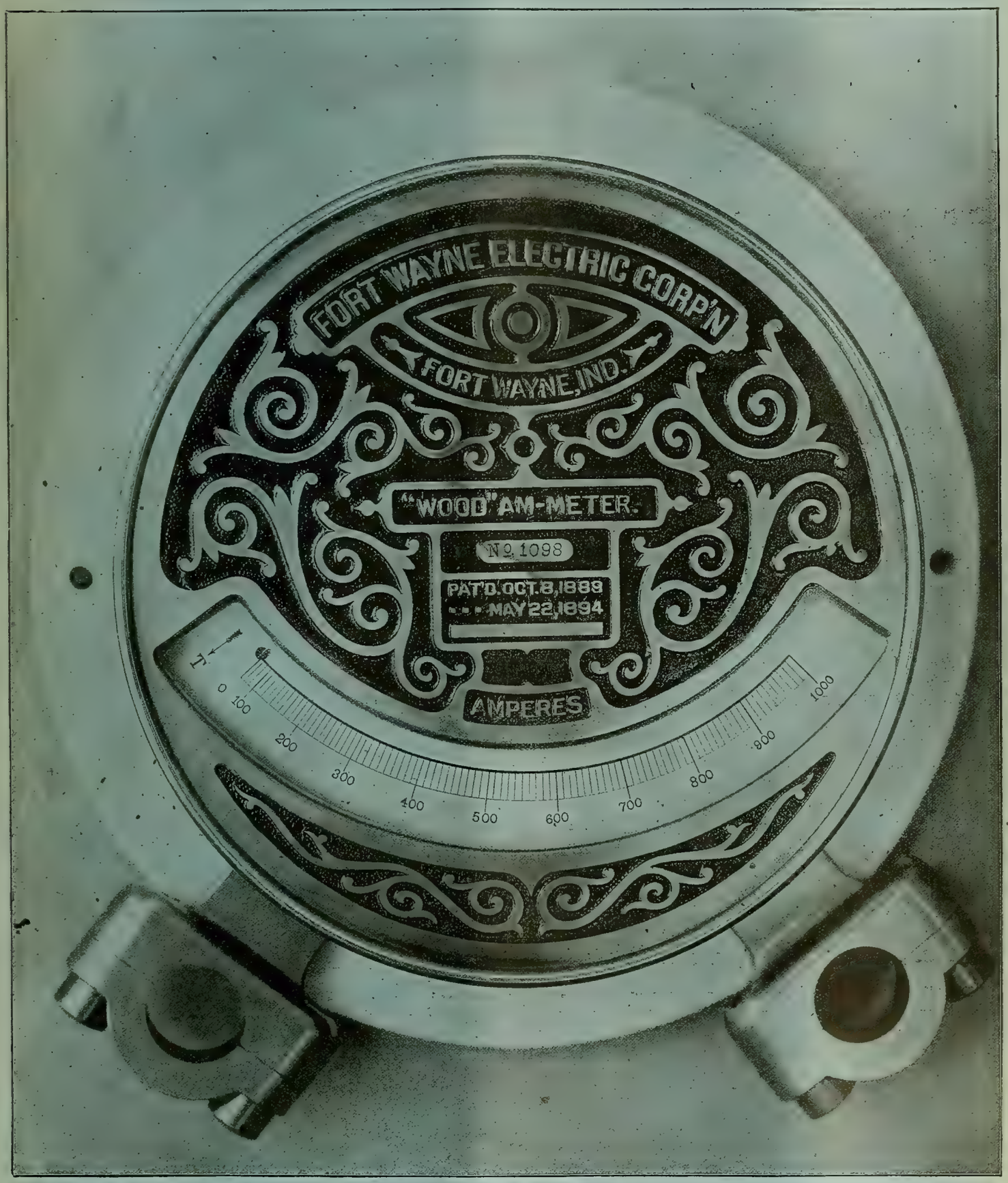


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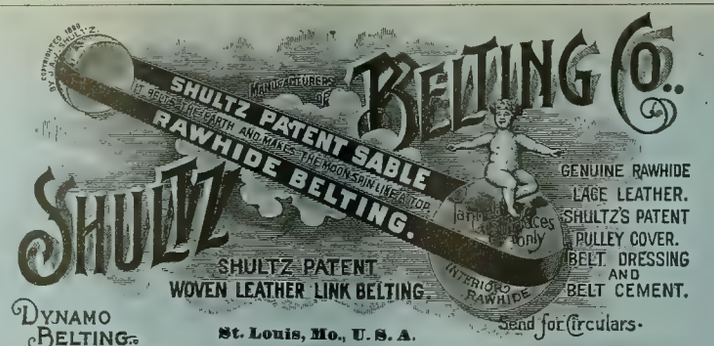


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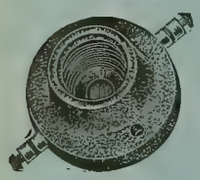

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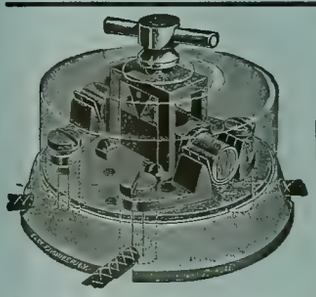

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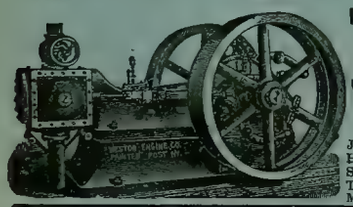

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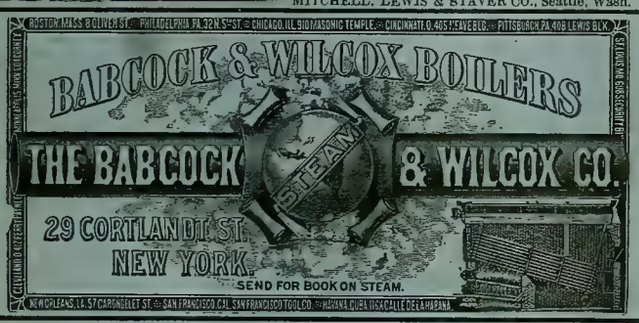


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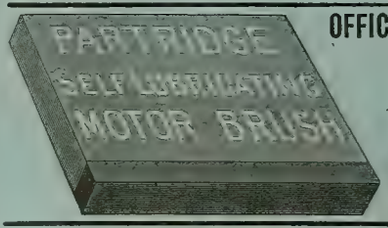


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Weston Engine Co..... .. i


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Hart & Hegeman Mfg. Co.
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Platt, O. S.
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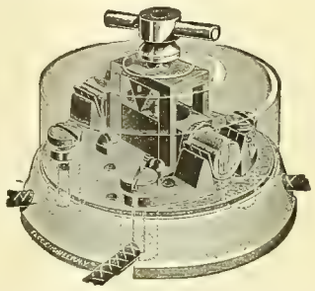

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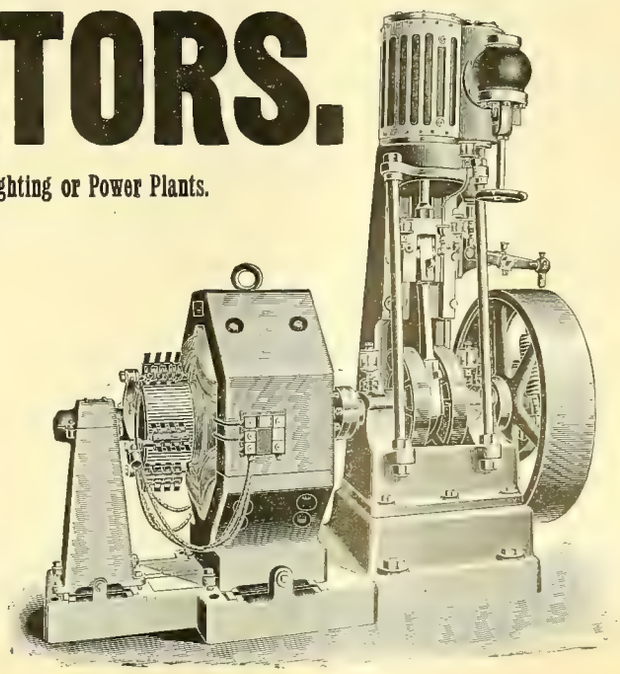

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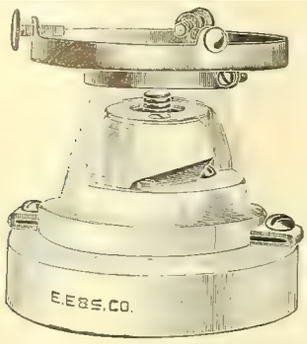


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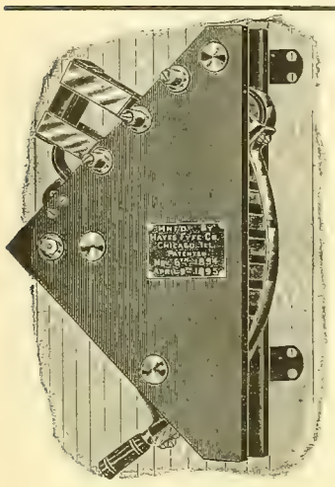

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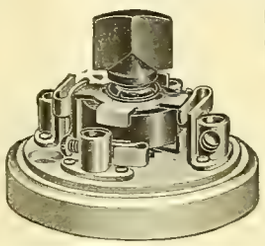

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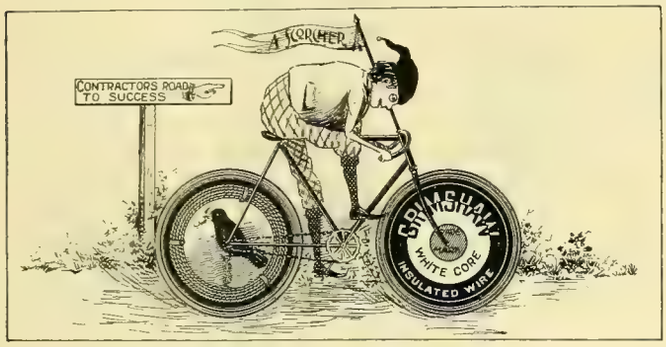


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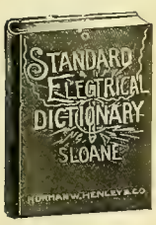


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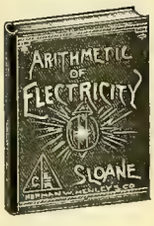


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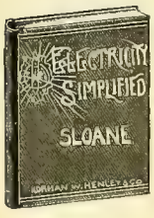


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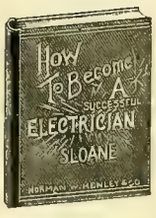


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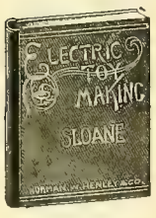


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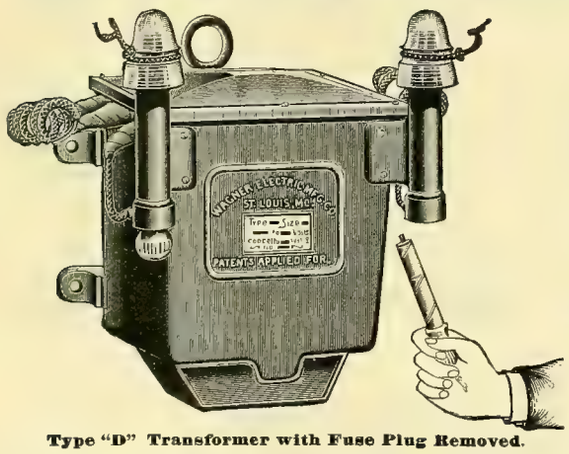


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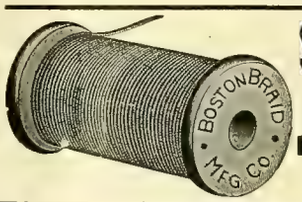


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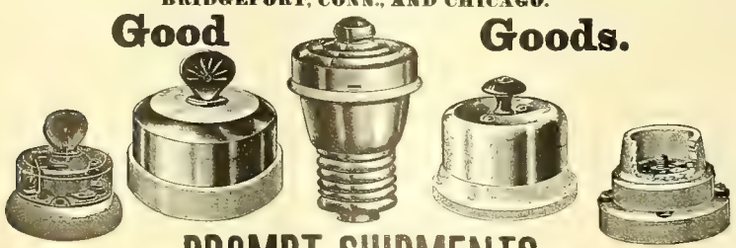

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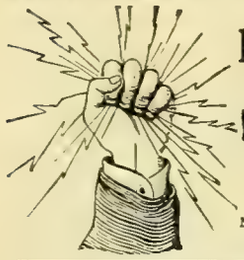

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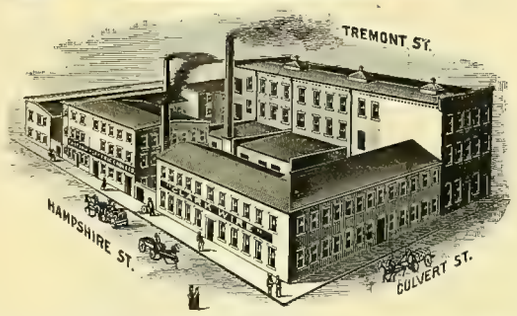


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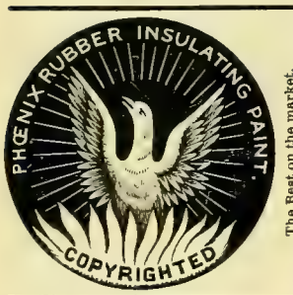


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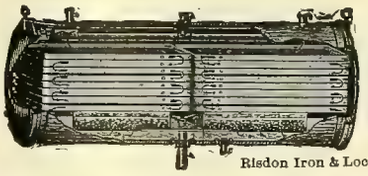

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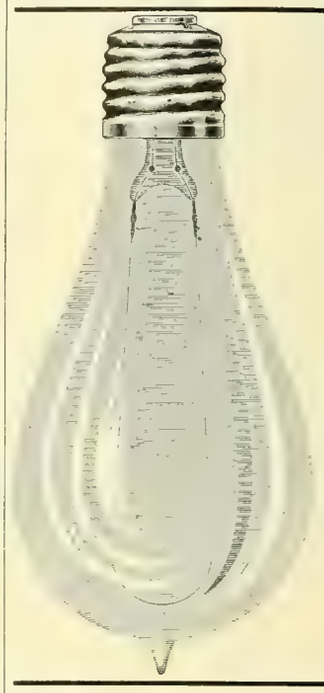

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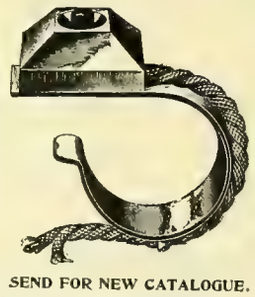

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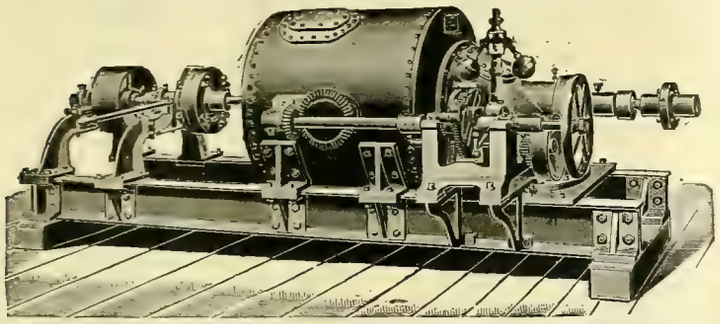

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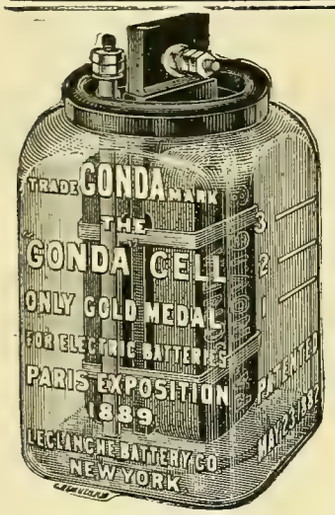


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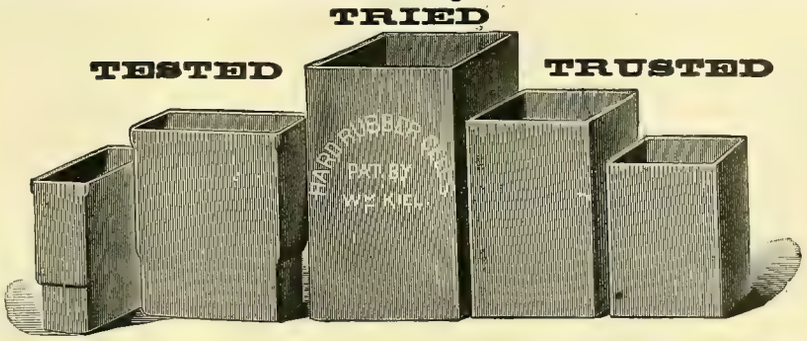


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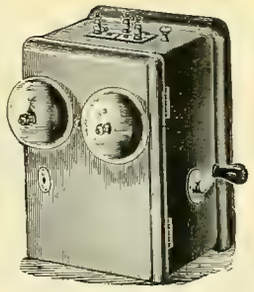

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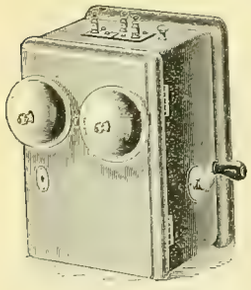

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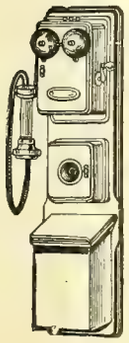

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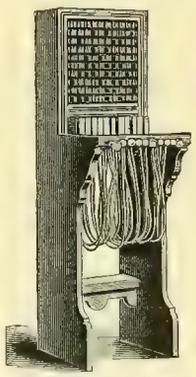

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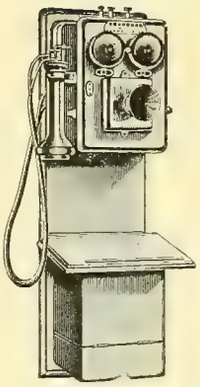

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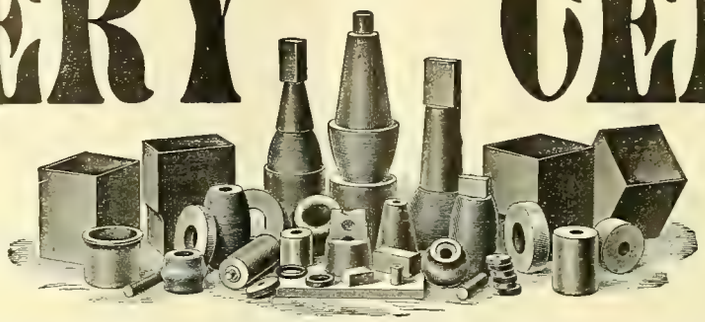

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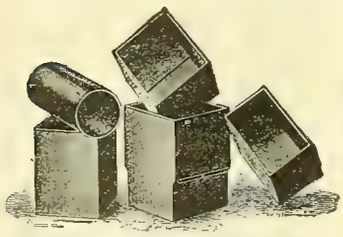

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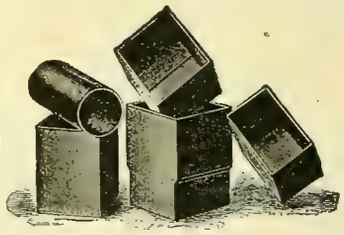

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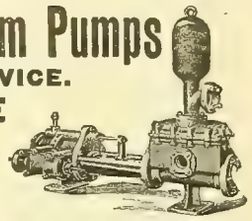
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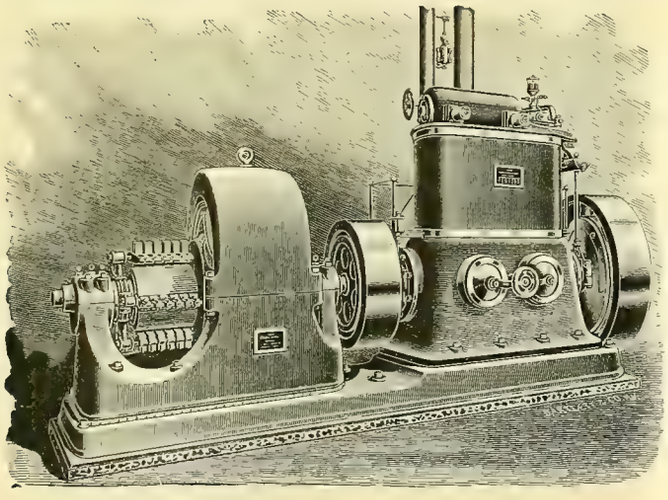

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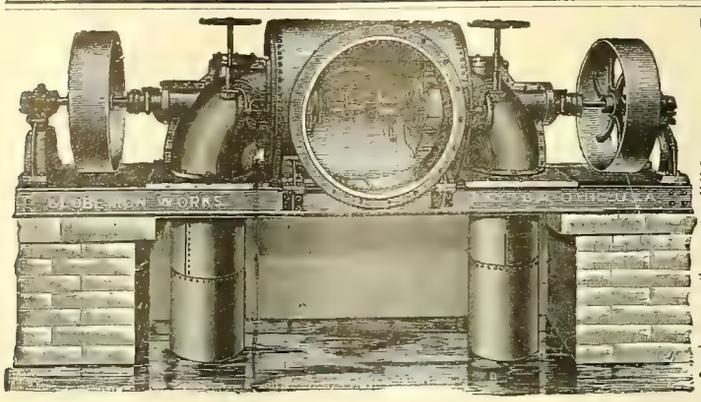

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| ⅞ " | 16.42 | 122.00 | 127.18 | 195.19 | 82.55 |
| ¾ " | 16.78 | 117.33 | 112.60 | 175.74 | 82.18 |
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|---|---|---|---|---|---|
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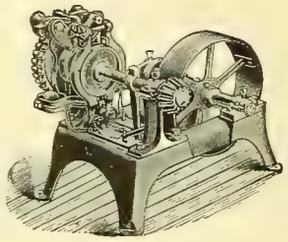

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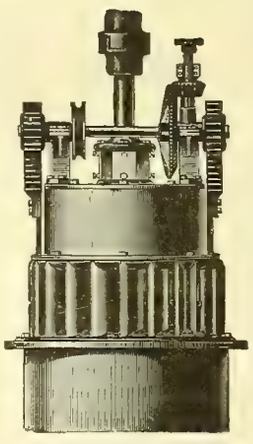

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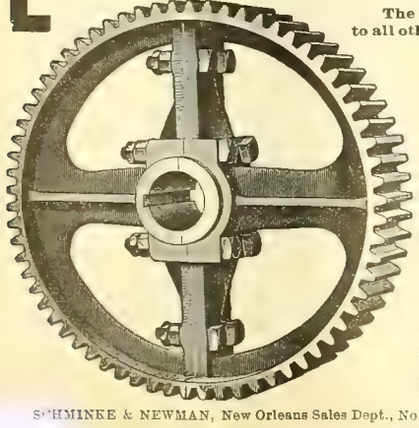

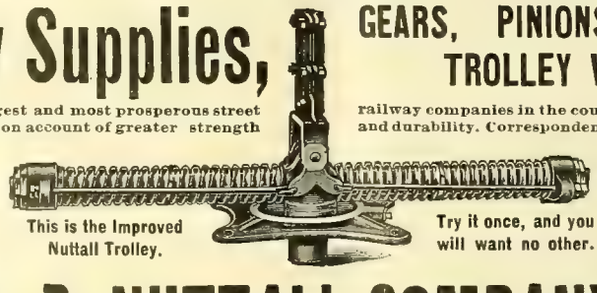

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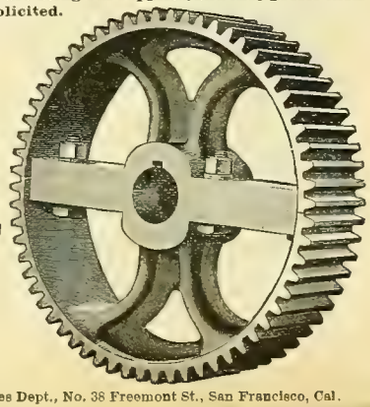

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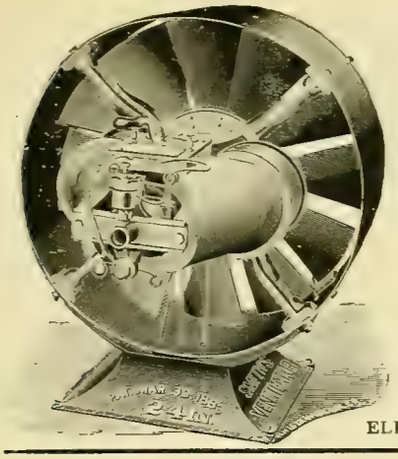

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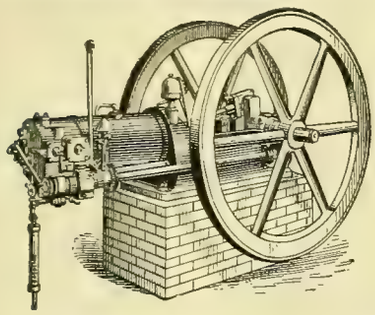

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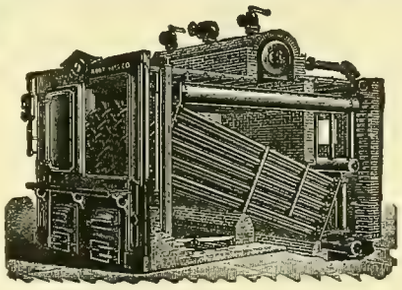

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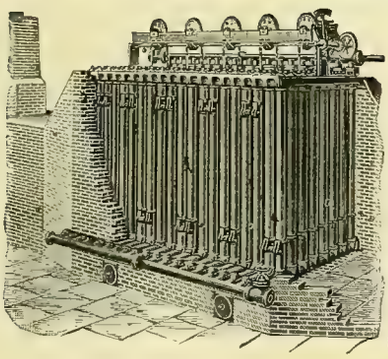

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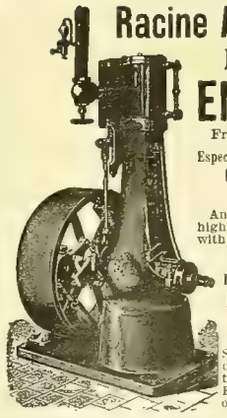

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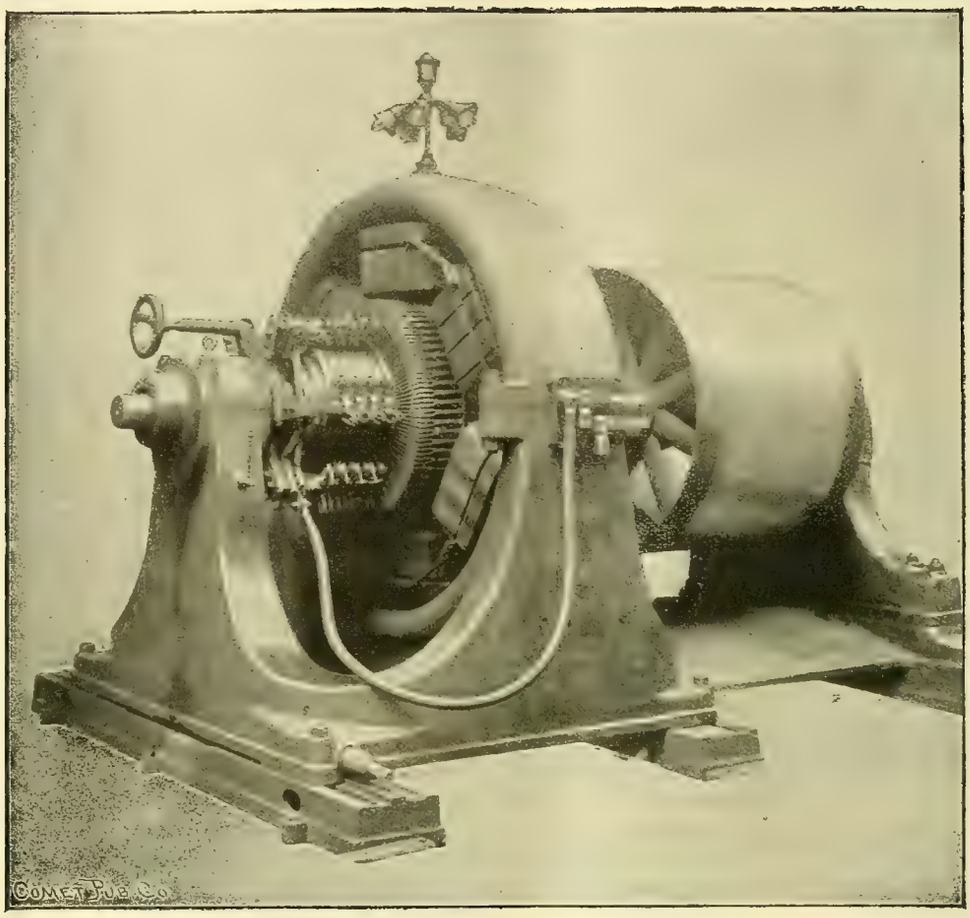


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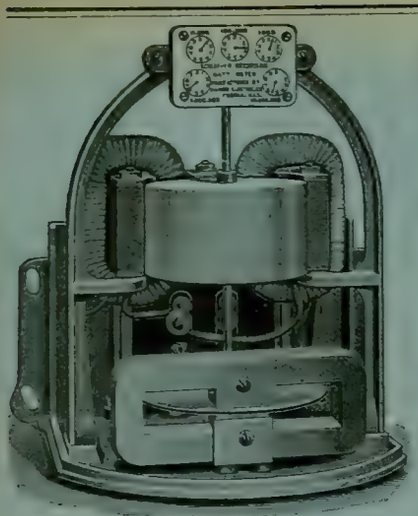

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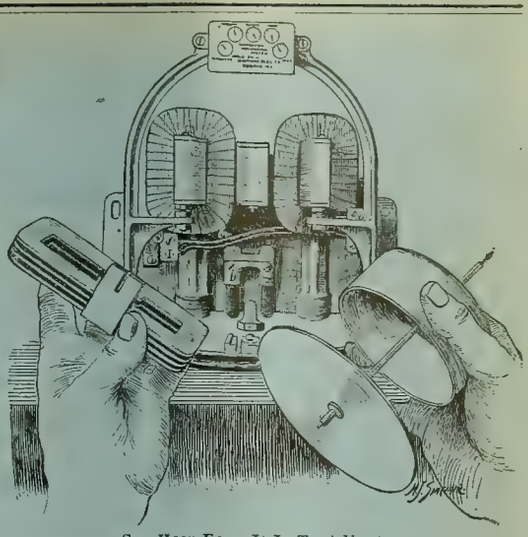

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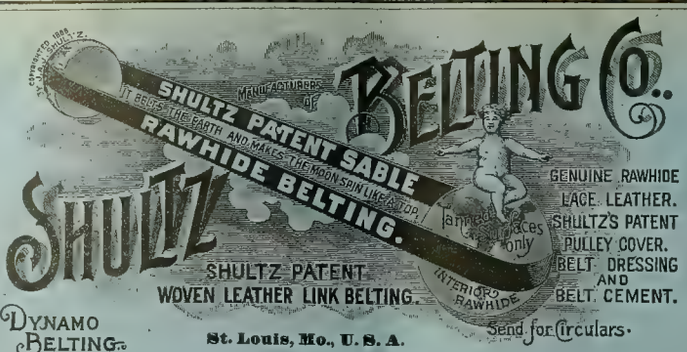


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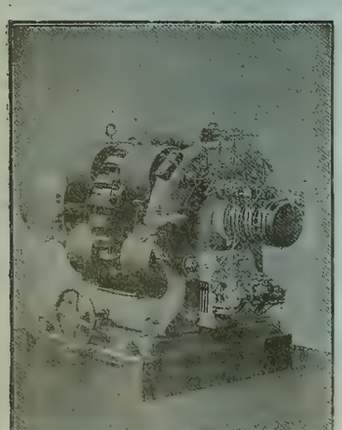

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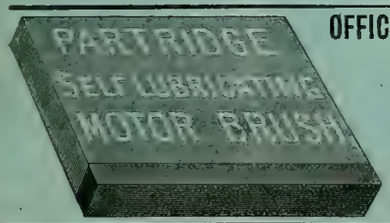


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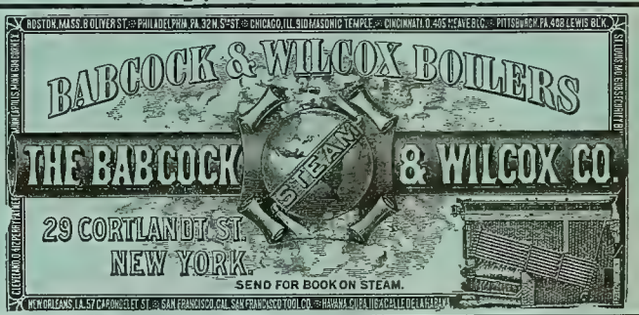


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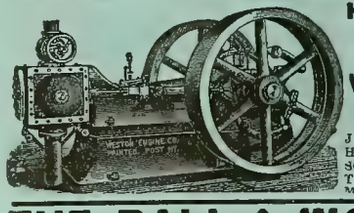

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Complete Power Plants.
Estimates and Drawings Submitted.

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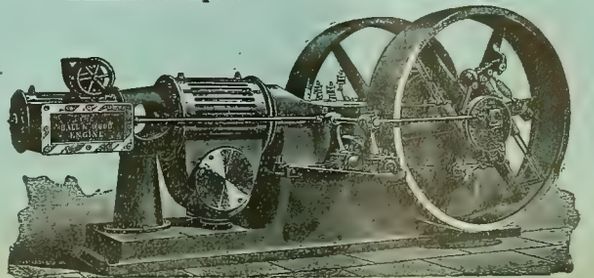
MITCHELL, LEWIS & STAVER CO., Seattle, Wash.

## THE BALL & WOOD COMPANY,

Builders of Improved Automatic Cut-off Engines.



REPRESENTATIVES:

Stern & Silverman, 707 Arch St., Philadelphia, Pa.
George M. Kenyon, Endicott Arcade, St. Paul, Minn.
C. E. Sargent, Fort Dearborn Bldg., Chicago, Ill.
James & Company, Chattanooga, Tenn.

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**BY OUR**

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St. Louis, Mo., Wainwright Building.
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Denver, Colo., 505 16th Street.
San Francisco, Cal., 15 First Street.
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For all business outside the United States and Canada: Foreign Department, Schenectady, N. Y., and 44 Broad Street, New York.

For Canada, address Canadian General Electric Company, Ltd., Toronto, Canada.

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Ohio Storage Battery Co.

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Chicago Gen'l Fixture Co.
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Corey, R. B.
Crocker-Wheeler Elec. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Solar Electric Co.
Standard Electric Co.
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Wat rman, C. H.
Westinghouse El. & Mfg. Co.

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Bunnell & Co., J. H.
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Edgerton Pottery Co.
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Electric Storage Battery Co.
Hemingray Glass Co.
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Miamisburg Electric Co
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Ohio Storage Battery Co.
Partrick & Carter Co.
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Central Electric Co.
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Shultz Belting Co.

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White Mfg. Co.

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Babcock & Wilcox Co., The.
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Phosphor Bronze Sm.Co., Ltd.

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Central Electric Co.
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Central Electric Co.
Electric Appliance Co.
Partrick & Carter Co.
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**Cables, Electric** .(See Insulated Wires), **Copper, Sheet and Bar.**
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Central Electric Co.
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Elec. Engr. & Supply Co.
Moore, Alfred F.
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Standard Underground C.Co.
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Wertheim, Ed.
Western Electric Co.

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Chisholm & Co , A.
Standard Paint Co.

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Interior Conduit & Ins. Co.

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Ft. Wayne Elec. Corporation.
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Bain, Foree.
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Bryan, Wm. H.
Card Electric Co.
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Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
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Ft. Wayne Elec. Corporation.
General Electric Co.
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Royal Electric Co
Sells, O. P.
Siemens & Halske Elec. Co.
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Walkins, Louis E.
Westinghouse Elec & Mfg. Co.
Western Electric Co.

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Besly & Co., Chas. H.
Miamisburg Electric Co.

**Copper Wire Bought.**

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Besly & Co., Chas. H.
Brixey, W. R.
Bunnell & Co., J. H.
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Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.
National India Rubber Co.
Okonite Co. The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Western Electric Co.

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McEvoy, C. H.
Samson Cordage Wks.

**Cranes.**
Harrington, Son & Co., E.

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Brady, T. H.
Central Electric Co.
Electric Appliance Co.
Elec Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Nuttal Co,, R. D.
Partrick & Carter Co.

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Anderson, Albert & J. M.
Andrae & Sons, J.
Bryant Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Edison Co.
Chicago Gen'l Fixture Co.
Colgate Co., Geo. L.
Crocker-Wheeler Elec. Co.
Diamond Electric Co.
Eddy Elec. Mfg. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric Protection Co.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Forest City Elec. Wks.
Forsyth & Fisk.
Ft. Wayne Elec. Corporation.
General Electric Co.
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Huebel & Manger.
Interior Conduit & Ins. Co.
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Partrick & Carter Co.
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Solar Electric Co.
Wagner Elec. Mfg. Co.

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Central Electric Co.
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Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Roth Bros. & Co.
Royal Electric Co.
Siemens & Halske Elec. Co.
Standard Electric Co.
Walker Mfg. Co.
Western Electric Co.
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General Electric Co.
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Bain, Foree.
Bryan, Wm. H.
Chic. Elec.-Mech. Ent. Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Selle, O. P.
Thayer Electric Co.
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Electric Appliance Co.
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General Electric Co.
Independent Electric Co.

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Partrick & Carter Co.

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Nuttall Co., R. D.

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Chicago Gen'l Fixture Co.
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General Electric Co.
Interior Conduit & Ins. Co.
Louisville Elec. Wks.
MacCurdy & Smith.
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Partrick & Carter Co.
Platt, O. S.
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S. K. C. Specialty Co.
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Thayer Electric Co.

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Dixon Crucible Co., Jos.

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Brixey, W. R.
Bunnell & Co., J. H.
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Chisholm & Co., A.
Crocker-Wheeler Elec. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Empire China Works.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Hart & Hegeman Mfg. Co.
Hemingray Glass Co.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Louisville Elec. Wks.
MacCurdy & Smith.
Munsell & Co., Eugene.
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Newton Rubber Wks.
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Farr Tel. & Const. Supply Co.
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Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Simplex Electrical Co.
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Buckeye Electric Co.
Central Electric Co.
Electric Appliance Co.
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General Electric Co.
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Partrick & Carter Co.
United Elec. Imp. Co.
Westinghouse Elec. & Mfg Co.

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Colgate Co , Geo. L.
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Westinghouse El. & Mfg Co.

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Garlock Packing Co.

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Phosphor Bronze Sm.Co. Ltd

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Baker & Co.

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Manistee Iron Wks. Co.

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Partrick & Carter Co.

**Rheostats.**
Central Electric Co.
General Electric Co.
Royal Electric Co,

**Sal Ammoniac.**
Klipstein & Co., A.

**Silk Braid.**
Boston Braid Mfg. Co.

**Speaking Tubes.**
Central Electric Co.
Electric Appliance Co.
Ostrander & Co., W. R.
Partrick & Carter Co.

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Colgate Co., Geo. L.
Diamond Electric Co.
Queen & Co. Inc.
Weston Electrical Inst. Co.
Whitney Elec. Inst. Co.

**Springs.**
Barnes, Wallace.

**Steam Heating.**
Goubert Mfg. Co.
Webster & Co., Warren.

**Storage Batteries.**
Bradburry-Stone E. S. Co
Electric Storage Battery Co
Ohio Storage Battery Co.

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Brill, J. G. Co.

**Tapes, Insulating.**
American Electrical Works
Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co
Okonite Co., The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Paint Co.

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A Powerful Tool. Suitable for

Holds 3 pints of oil; burns about 4 hours with one filling and pumping.

Electricians, Brass Workers and Pattern Makers, Bicycle Manufacturers, Machinists and Tool Makers, Locksmiths and Bell Hangers, Coppersmiths and Boilermakers, Wagon and Carriage Makers and Artisans Generally.

For brazing and tempering small tools and springs, soldering patterns and annealing brass and other metals, heating soldering coppers, glue, burning off paint, general bench furnace work, etc. Packed one dozen in case.

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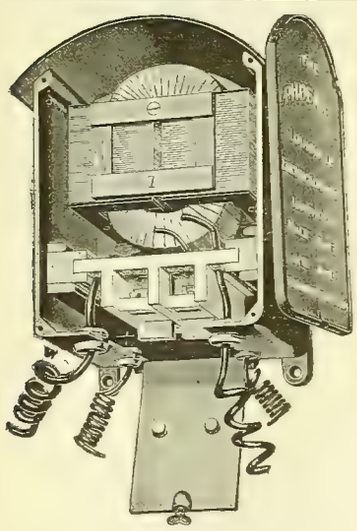

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Is **UNEQUALLED** in its

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## ELECTRICAL SUPPLIES,

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**A FULL LINE IN STOCK.**

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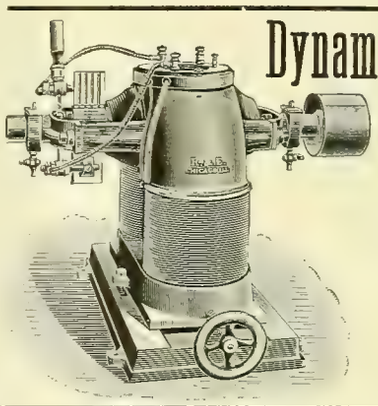

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**DYNAMOS,**
**8 to 75 Light Capacity.**

**ELECTRIC MOTORS,**
**1-8 to 7 Horse Power.**

High Efficiency, Best Material, Perfect Regulation, Low Prices.

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# ROYAL ELECTRIC CO., PEORIA, ILL.,

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# "ROYAL ALTERNATOR."

**No Commutator! No Moving Wire! Efficiency High! Regulation Close! Fully Guaranteed!**

**TRANSFORMERS OF ANY DESCRIPTION. DIRECT CURRENT GENERATORS AND MOTORS.**

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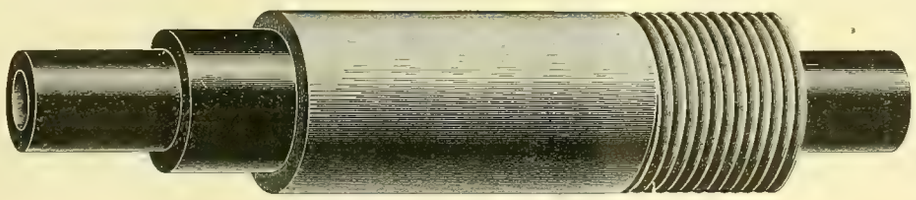
OKONITE THE DEFENDER

THEY NEVER DISAPPOINT.



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## THIS DRUMMER HAD A CINCH.

**Couldn't Tell Funny Stories, but Knew a Trick Worth Two of That.**

A drummer, as the word drummer is understood in these piping times of peace, is a man who tells you a funny story and incidentally takes your order for goods. A faculty of making himself "solid" with his customers socially is one of the most valuable features of a successful drummer's equipment. The commercial traveler is a hail fellow well met wherever he goes. There are houses whose trade is so firmly established and its hold upon its patrons so strong that its goods sell themselves, almost, and the solicitor has very little soliciting to do. But even with houses of this character a smooth tongue and a ready wit count for much.

Occasionally there is a man who departs from the old lines, invents a method of his own, and makes a great success of it.

"What has become of that man Jones who used to travel for you?" asked one Randolph street jobber of another the other day. "I suppose he has gone off the road. I always thought he never would make a success of it; he was too chilly. He was the chilliest man I ever saw."

"There's just where you're wrong," replied the other jobber, who deals in linseed oil. "He was the most successful traveling man I ever knew. When he was on the road he kept us jumping to fill his orders. The only reason he isn't traveling for us to-day is that another house offered him a good deal bigger salary than we were willing to pay, and he is representing the other house now. He was very chilly, as you say. He was that way with everybody, his customers included. He never had a word to say to them about politics, and couldn't tell a funny story if he tried. He never talked anything but oil. As soon as he got an order he walked out and never tried to conceal the fact that that was all he had come for. Yet his customers thought he was the best friend they had in the world.

"This is how he did it. As a cold-blooded business proposition he decided that the strongest hold he could get on a man would be a hold on his pocketbook. He left the other drummers to do the amusing part of it, but he studied the oil market. He seemed, besides, to have an intuition about the fluctuations of prices which was almost prophetic. When he saw that oil was about to go up he sat down and telegraphed to all his customers, 'Buy oil.' They followed his advice, and in nine cases out of ten they saved a lot of money by it. It only took a few experiences like this to convince them that it was a serious mistake to buy oil of anybody else. He was hardly a solicitor at all. When he told a man to buy he bought."

### Had Been Learning.

"Dear little mother!" said the young man who had been away from home for six months, as he opened a letter addressed to him in the well-known handwriting of his maternal ancestor, "I wish she would go out into the world more and enjoy herself. She is such a domestic little body. I'll get all the news now about the last housecleaning and how the cat and the canary are getting along, and all about having the kitchen painted and buying new rugs for the back parlor, and so forth."

Then he opened the letter and read

"DEAR HARRY: I have just returned from seeing a ball game between our college nine and the team from Miggsville. Our boys were all crippled up. Burnham had a glass arm, Hawkins was almost laid up with a Charley-horse, and Spicer had a game foot. One of the stiffs from Hankinsburg had spiked him three days before. But it would have done you good to see how they fell on that Miggsville pitcher. They pasted him all over the field for six runs in the first inning, all of them earned, and 'Trick' Jackson made one of the longest hits ever seen on the grounds. It was a corking three-bagger, and if Fuddleston had been doing his duty in the coachers' position it would have been a home run. In the fourth inning they knocked the Miggsville twirler out of the box," etc.

## *OUT OF THE GINGER JAR.*

### His Answer.

He rings the bell of the telephone
And, quiet as to make him dizzy,
He gets reply in a monotone—
It is either bzzz or buzz-y!

### Mortuary Statistics Out West

Tenderfoot—"You have a salubrious climate here, I believe?"

Woollywest—"Tol'able, for some folks."

Tenderfoot—"What are the most frequent causes of death according to statistics?"

Woollywest—"W'al, six-shooters, I reckon. Little knifin' and some Winchesters, but they ain't nothin' after all that gits around the six-shooter in a pinch."

### His Way of Putting It.

Conductor in a crowded street car: "Room in the rear of the car for one lady or two gentlemen!"

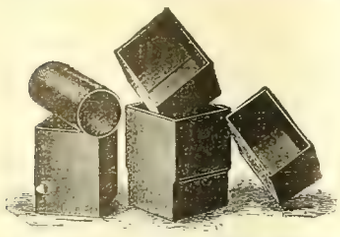
### And Nothing in a Name?

Landlord—"I guess I'll have to raise your rent."

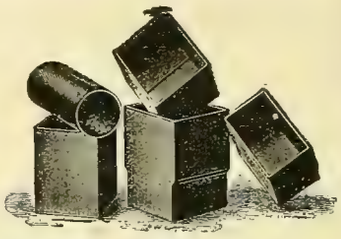
Tenant—"For what."

Landlord—"They've changed the name of this street and it's now an avenue."

—Chicago Record.



# THE FREEMAN BATTERY CELLS.



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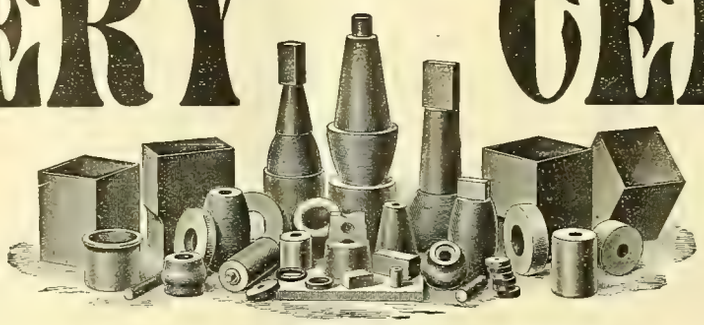

Standard Sizes Always on Hand.

The composition used in the manufacture of these battery cells makes them positively acid-proof, which result has never before been accomplished providing additional strength to such an extent that this cell can be used where no other would be practical.

## THESE CELLS ARE A NEW PRODUCTION AND FULLY GUARANTEED.

**AGENTS WANTED IN ALL CITIES.** **WRITE US FOR INFORMATION AND CATALOGUE.**

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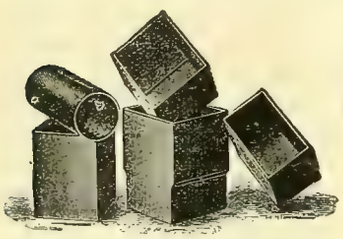
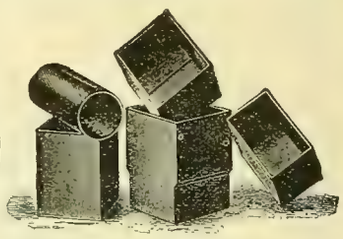


# Newton Rubber Works,

Newton Upper Falls, Mass.



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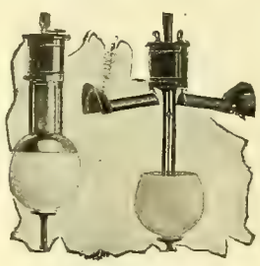

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Reversible Motors and Controllers for Rolling Mills, Bridges and Traveling Cranes.

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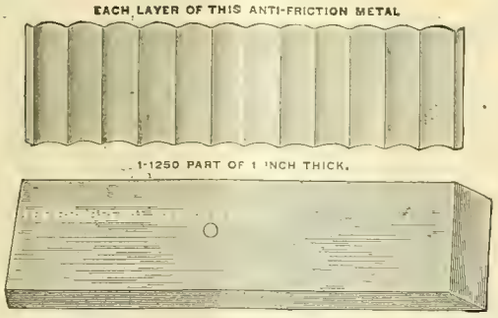


The Boudreaux Dynamo Brush Co. NO WOVEN WIRE.

The Boudreaux Dynamo Brush Co. NO COPPER.

**THE BOUDREAUX DYNAMO BRUSH CO.,**

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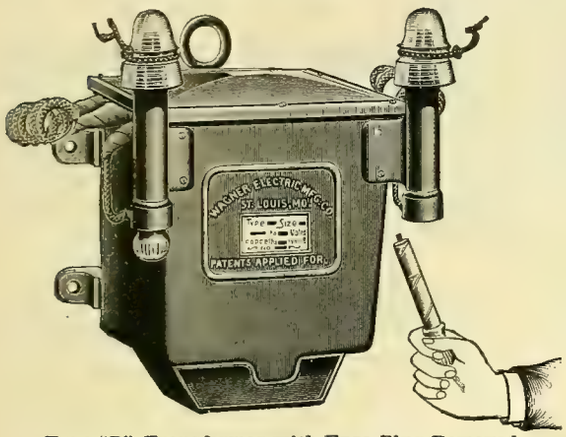
# TRANSFORMERS.

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***A New Type*—*Transformer, Primary Cut-outs and Insulator Brackets all combined.***

**No more brackets pulling off of walls.**

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***Our Transformers* are acknowledged by all experts to be the *Highest* in *Efficiency* ever made.**

**Adopted by the largest stations in the country.**

***We Challenge Competition* in any form of test, in laboratory or practical use.**

**Made in all sizes, 5 lights to 3,000 lights.**

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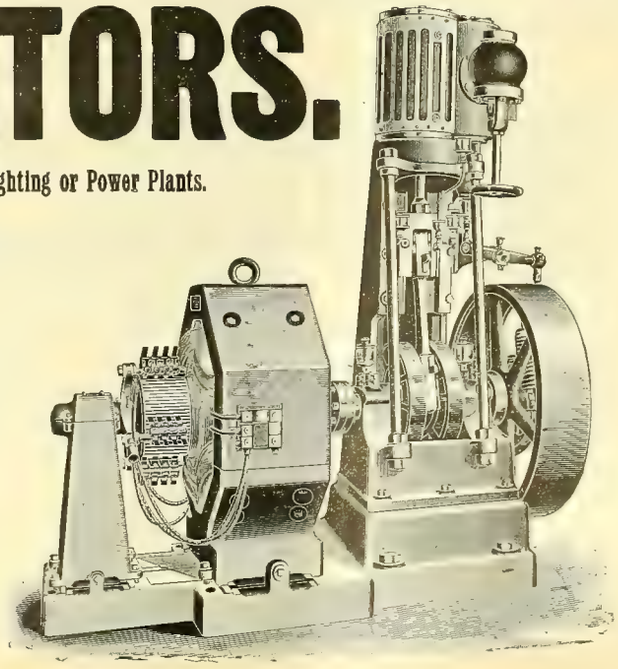
***We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.***



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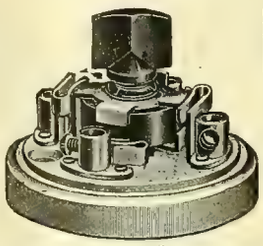

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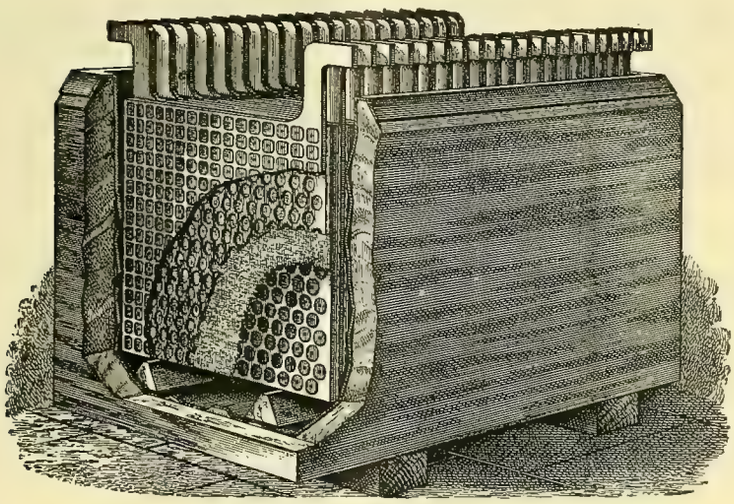

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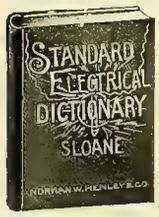


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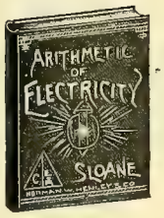


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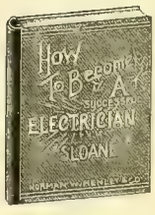


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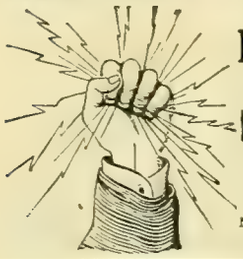

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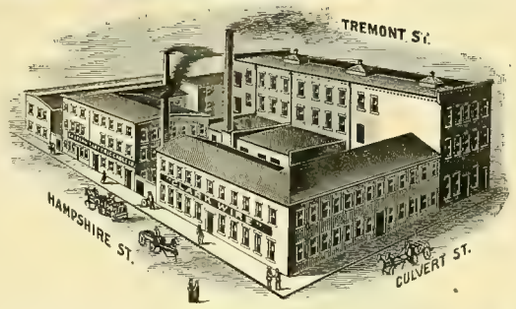


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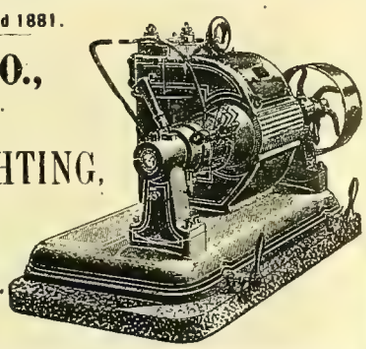

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Position as electrician, incandescent wireman, dynamo tender, engineer, trimmer or for all-round central station work. Best of references. Any company in need of a hard worker will please address, "E. R.," care of WESTERN ELECTRICIAN, 6 Lakeside Building, Chicago.

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Two 360 light, 110 volt Edison incandescent dynamos; one 275 light, 110 volt Mather incandescent dynamo; one 300 light, 110 volt T.-H. incandescent dynamo. All in first-class working order.

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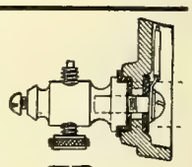

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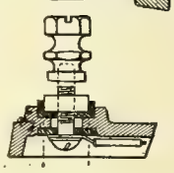

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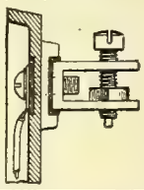

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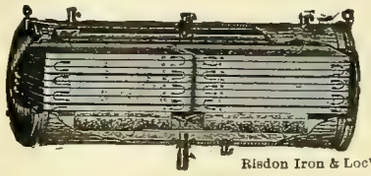

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Entirely prevents *scale* in Steam Boilers. Catalogue on application.

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## Mt. Sterling, Ohio, Water Works.

Sealed proposals will be received by the Mayor and Council of the incorporated Village of Mt. Sterling, Madison County, Ohio, until 12 o'clock, noon, Tuesday, the 1st day of October, 1895, for furnishing all work and materials necessary for the construction of a system of water works for said village, as follows:

One pumping station.

One duplex steam pump, 500,000 gals. capacity per 24 hours.

One, or more, deep well pumps, 150,000 gals. capacity.

One stand pipe, 16x80 ft.

About 164 tons cast-iron pipe 8 to 4 inches.

28 fire hydrants.

26 valves and valve boxes.

One, or more, drilled wells.

Alternate proposals will also be received for air lift pumping machinery.

Each proposal must be accompanied by cash or certified check of amount equal to 5 per cent. of the amount of the bid, made payable to John W. Hanawalt, Village Clerk, as a guarantee of good faith on the part of the bidders.

All proposals must be made on blanks furnished and shall be sealed and addressed to John W. Hanawalt, Clerk of said Village, and endorsed, Proposal for Water Works.

So far as possible contractors shall employ home labor and purchase material from home dealers in the execution of the work.

Plans and specifications can be seen and blank forms of proposal obtained at the office of said clerk after September 5th, 1895,

Council reserves the right to reject any and all bids.

Printed copy of specifications can be obtained by addressing said clerk.

H. CLAY JOHNSON, Mayor.
JOHN W. HANAWALT, Clerk.

Dated at Mt. Sterling, Ohio, August 29, 1895.

E. C. COOKE, Engineer,
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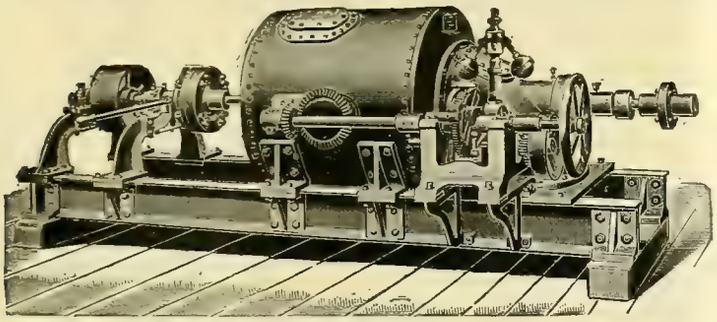

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The attention of ELECTRIC COMPANIES is called to this **CELEBRATED WATER WHEEL** as particularly adapted to their use, on account of its **remarkably steady motion, high speed and great efficiency and large capacity** for its **diameter,** being **double** the **power** of most wheels of the same diameter. It is used by a number of the leading electric companies with great satisfaction. In the economical use of water it is without an equal, producing the highest per cent of useful effect **guaranteed.**

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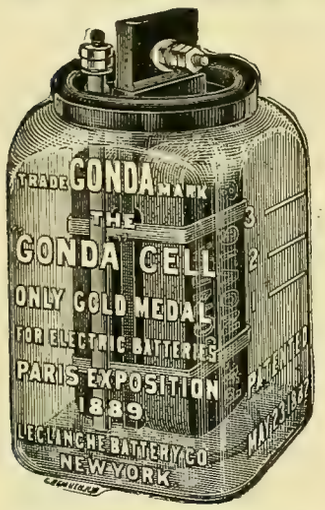


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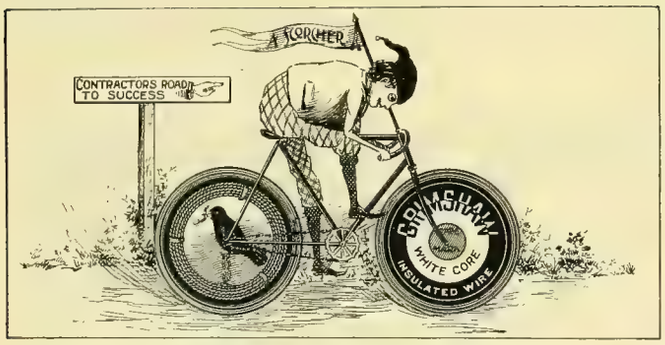


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Palestine Telephone Co., Palestine, Tex., 150 'phones.
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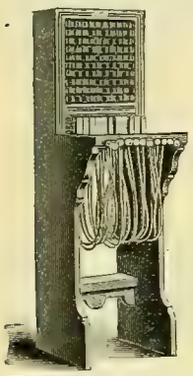

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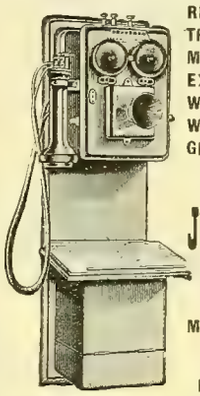

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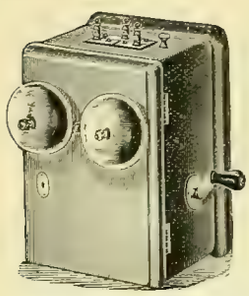

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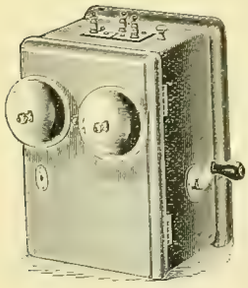

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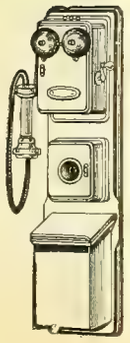

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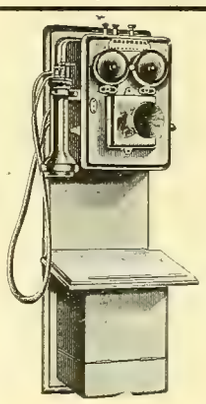

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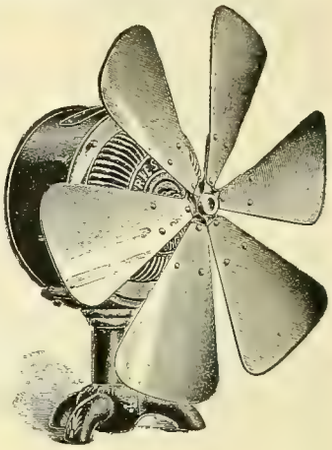

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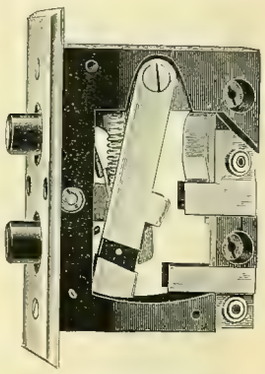

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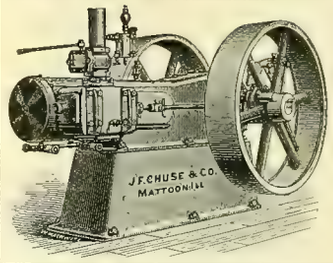

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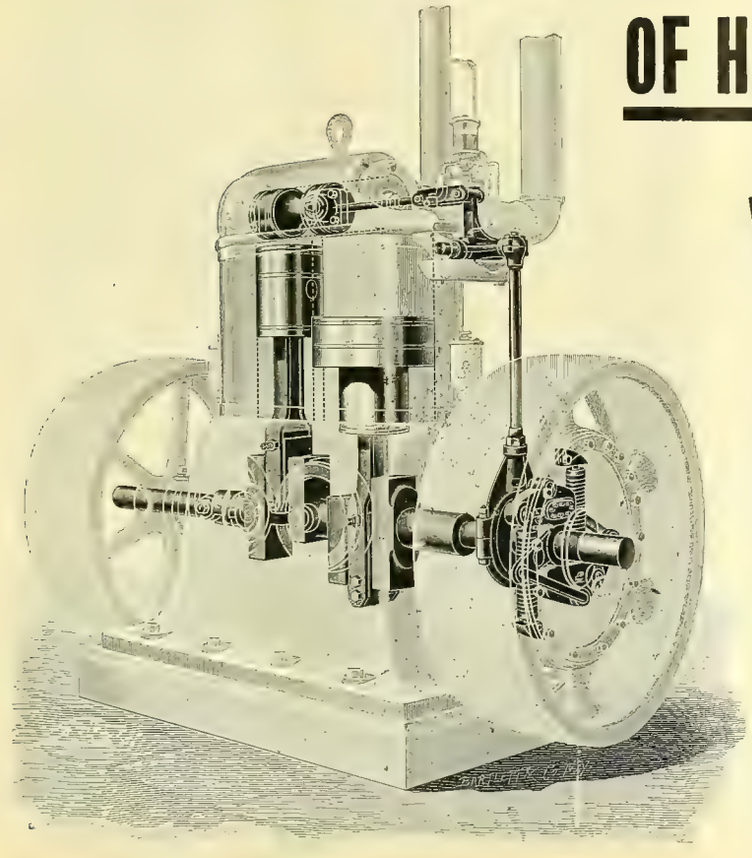

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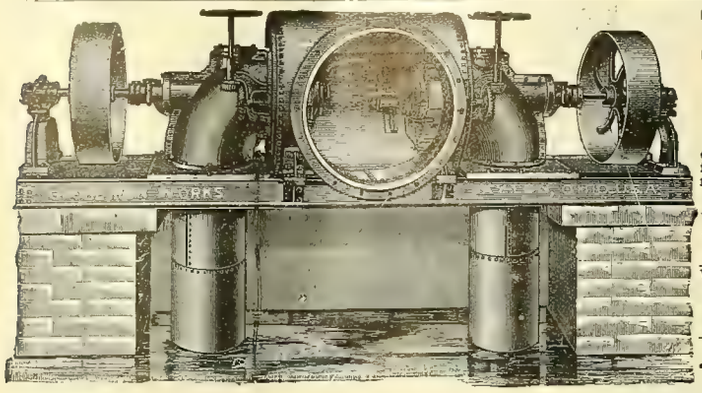

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| ⅞ " | 16.42 | 122.00 | 127.18 | 195.19 | 82.58 |
| ¾ " | 16.78 | 117.33 | 112 60 | 175.74 | 82.18 |
| ⅝ " | 17.03 | 111.83 | 98.12 | 149.99 | 79.31 |
| ½ " | 16.88 | 118.67 | 82.07 | 118 40 | 75.52 |

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|---|---|---|---|---|---|
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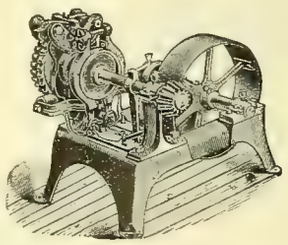

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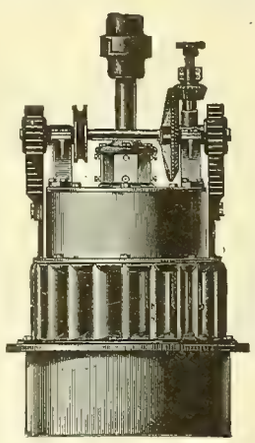

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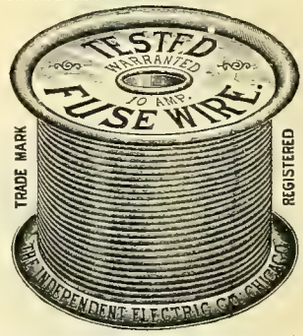


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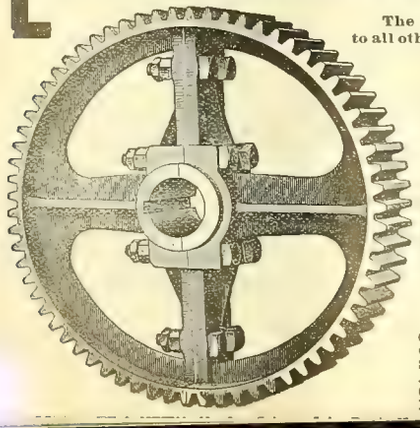

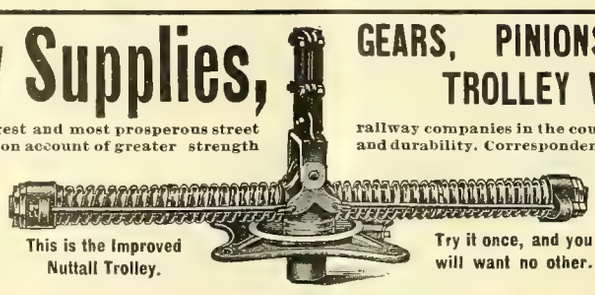

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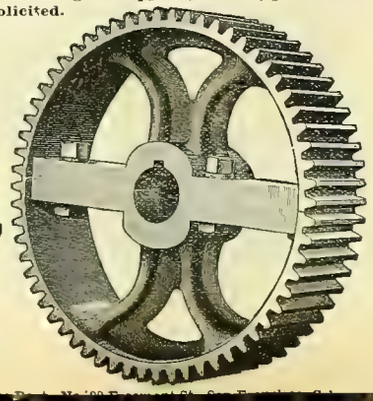

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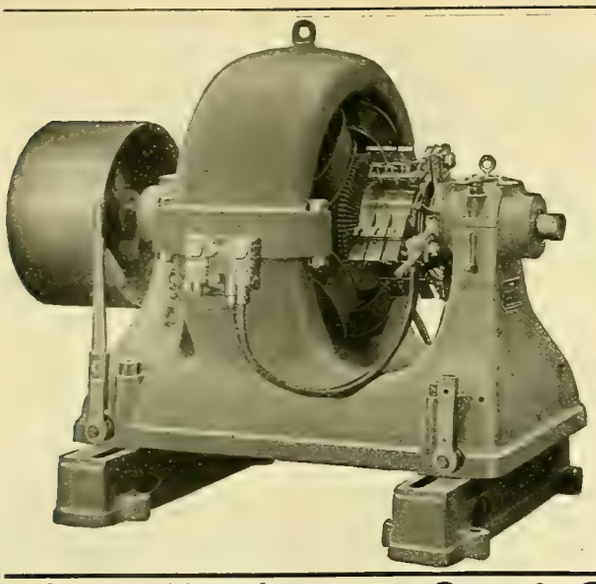

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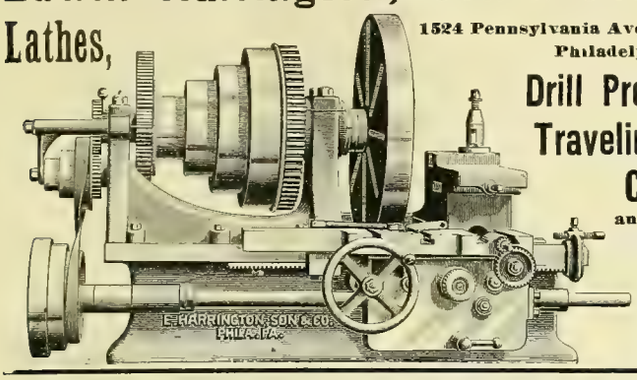


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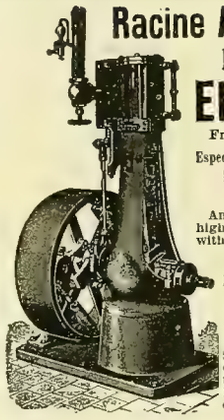

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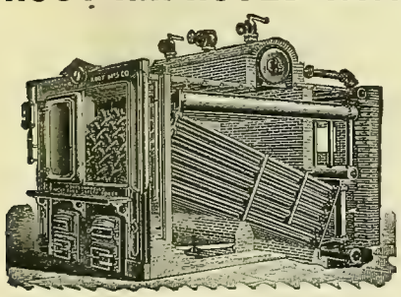

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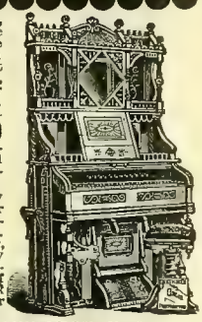

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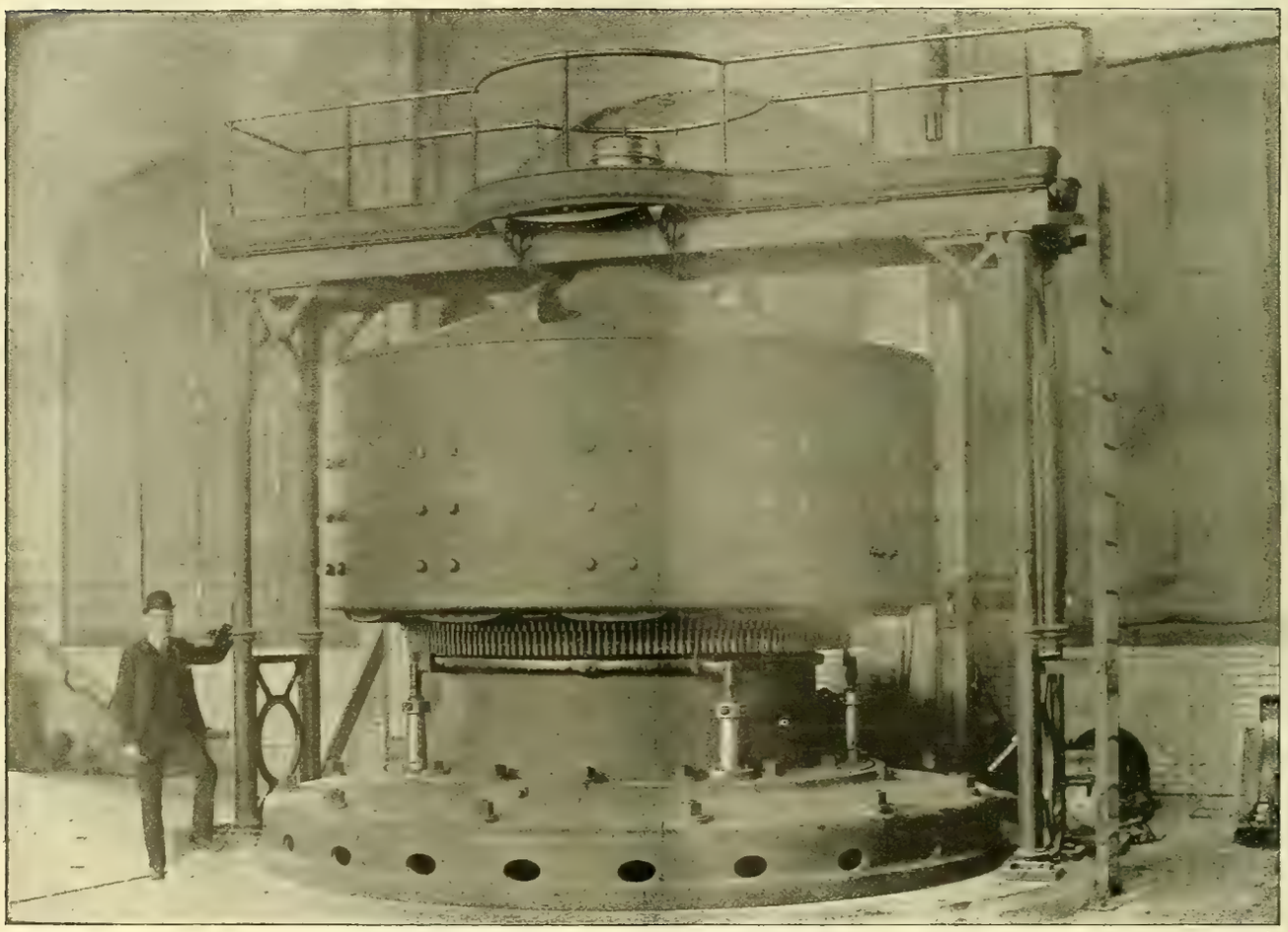

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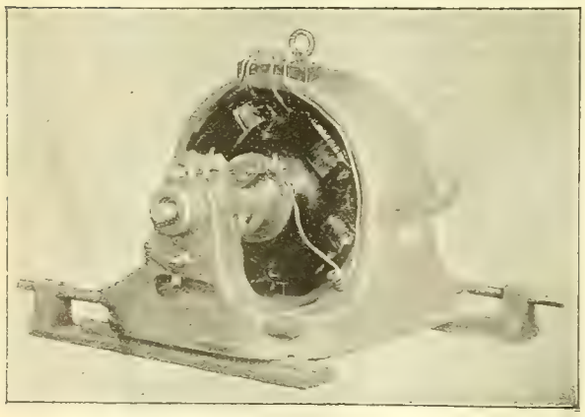

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**BY PROF. D. C. JACKSON, C. E.**

Member of the American Society of Mechanical Engineers; Member American Institute of Electrical Engineers;
Professor of Electrical Engineering, University of Wisconsin, Madison, Wisconsin.

* * * "In order to place before you independent data representing all the American "transformers of moderate capacities, I will give the results of a long and carefully carried "out series of tests made by A. H. Ford in the laboratory of the University of Wisconsin. "For these tests transformers of fifteen hundred watts capacity, as nearly as possible, were "procured directly from the manufacturers within about a year from this date, so that the "tests may be presumed to represent the latest and best designs which are now supplied. "These transformers are from the most prominent makers, and, in fact, include all impor- "tant makes of American transformers, with two or three exceptions.

"The results of the tests are given in the attached table.

| Number. | Watts Capacity. | Open Circuit Current. | | Watts Iron Loss. | | Watts Copper Loss Full Load. | Total Pressure Drop. | Efficiencies. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Full Load. | | All Day. | |
| | | $f$—125 | $f$—60 | $f$—125 | $f$—60 | | | $f$—125 | $f$—60 | $f$—125 | $f$—60 |
| 1 | 1250 | .043 | .066 | 37 | 48 | 30 | 2.5 | 95 | 94 | 85 | 83 |
| 2 | 1500 | .076 | .124 | 50 | 71 | 45 | 3.5 | 95 | 94 | 85 | 81 |
| 3 | 1500 | .052 | .100 | 32 | 46 | 38 | 4.0 | 96 | 95 | 89 | 85 |
| 4 | 2500 | .230 | .540 | 135 | 230 | 44 | 2.5 | 92 | 89 | 77 | 68 |
| 5 | 1800 | .076 | .600 | 53 | 109 | 67 | 5.0 | 94 | 92 | 85 | 75 |
| 6 | 2000 | .055 | .091 | 42 | 56 | 55 | 5.0 | 95 | 94 | 89 | 86 |
| 7 | 1000 | .028 | .064 | 24 | 28 | 53 | 3.0 | 95 | 94 | 87 | 86 |
| 8 | 1500 | .073 | .113 | 57 | 76 | 31 | 2.5 | 94 | 93 | 83 | 79 |
| 9 | 1500 | .077 | .144 | 43 | 55 | 28 | 3.0 | 95 | 95 | 86 | 84 |

**"These results, I find, do not differ very widely from those published by the Fort Wayne "Electric Corporation in a small blue-printed pamphlet, which, however, contains tests made "by the company upon only a few of the makes of transformers included in my table."**

**The transformer marked No. 1 in the above table, is a twenty-five light transformer of the Fort Wayne Electric Corporation's make.**

*Abstract from a paper read before the Northwestern Electrical Association at the summer meeting, held in Chicago, July 17, 18 and 19.


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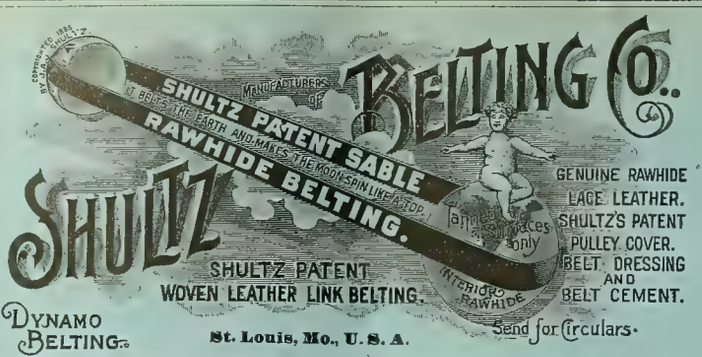


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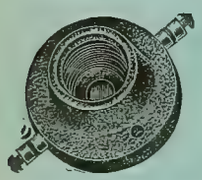

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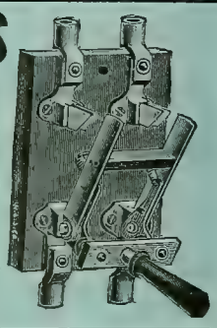

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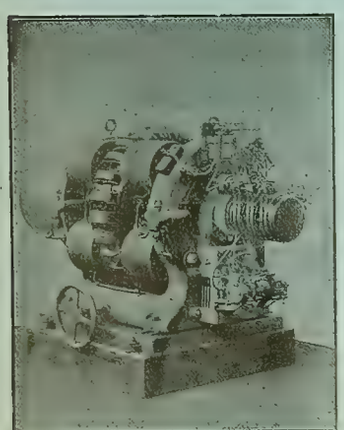

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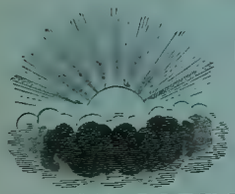

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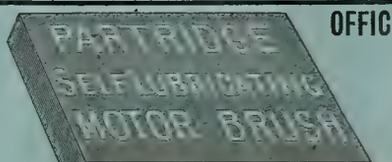


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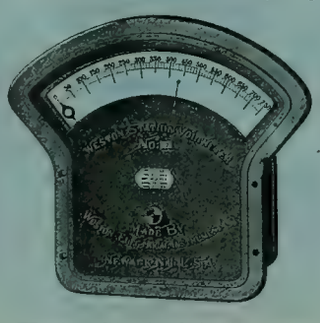

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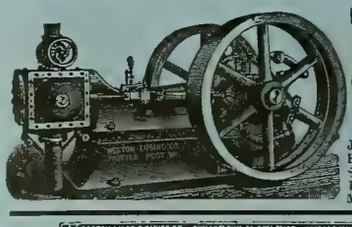

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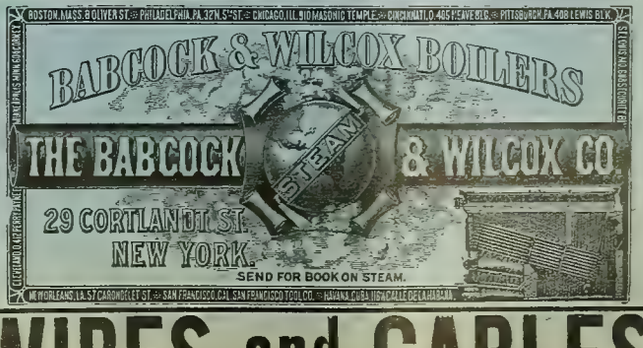


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Brixey, W. R.
Bunnell & Co., J. H.
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Fiberite Co., The.
General Electric Co.
Independent Electric Co.
National India Rubber Co.
Okonite Co. The.
Phillips Insulated Wire Co.
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Standard Underground C. Co.
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Brady, T. H.
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Farr Tel. & Const. Supply Co.
Fiberite Co., The.
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Brixey, W. R.
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Chisholm & Co., A.
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Hart & Hegeman Mfg. Co.
Hemingray Glass Co.
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Eastern Electric Cable Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
General Electric Co.
Independent Electric Co.
Metropolitan Electric Co.
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National India Rubber Co.
New York Insulated Wire Co.
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General Electric Co.

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Am. Silk Mfg. Co.

**Magnet Wire.**
(See Insulated Wires.)

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Harrington, Son & Co., E.
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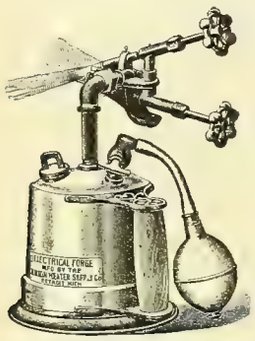

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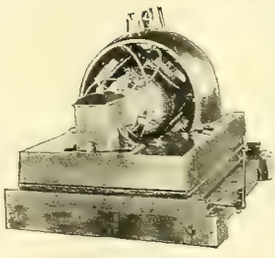

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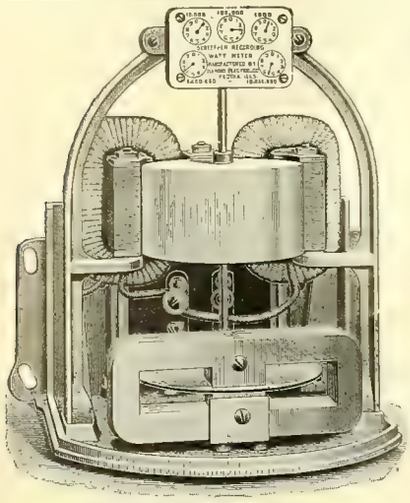

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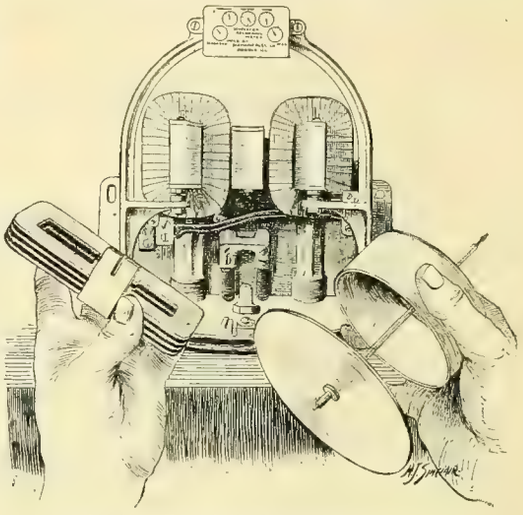

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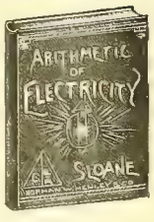


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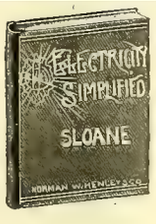


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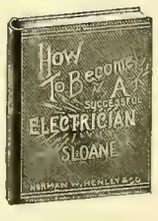


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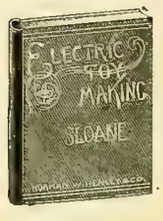


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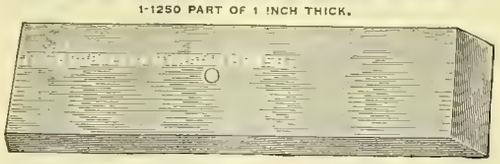

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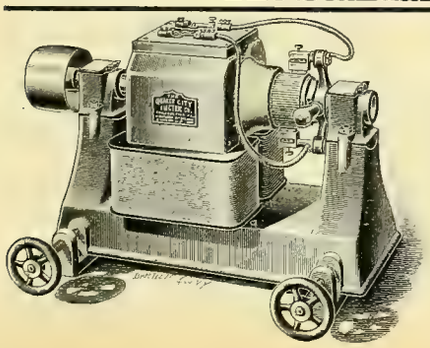

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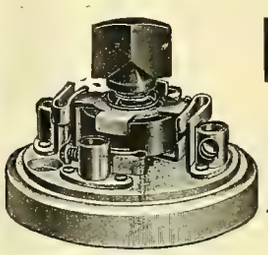

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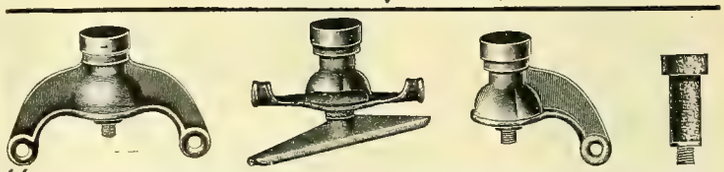

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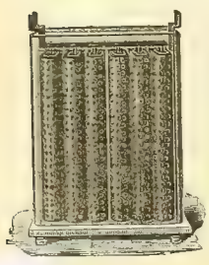

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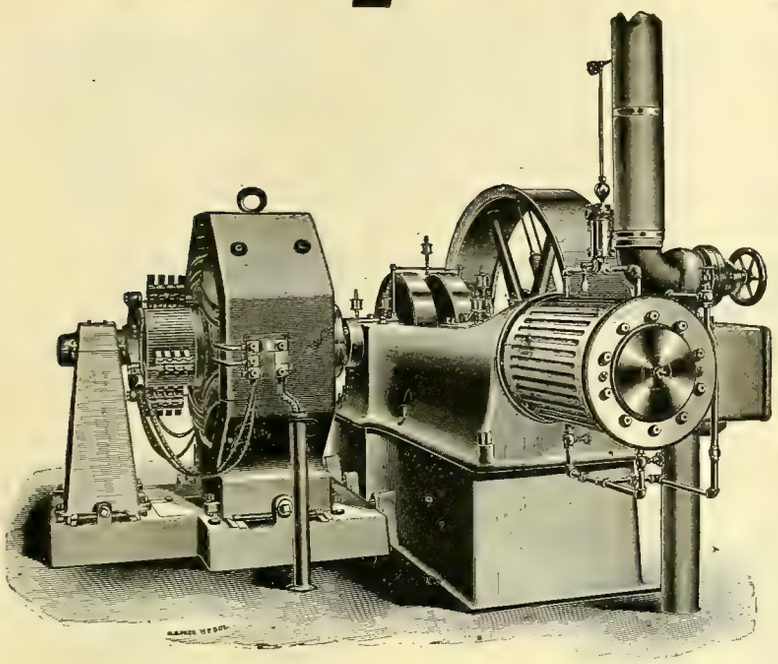

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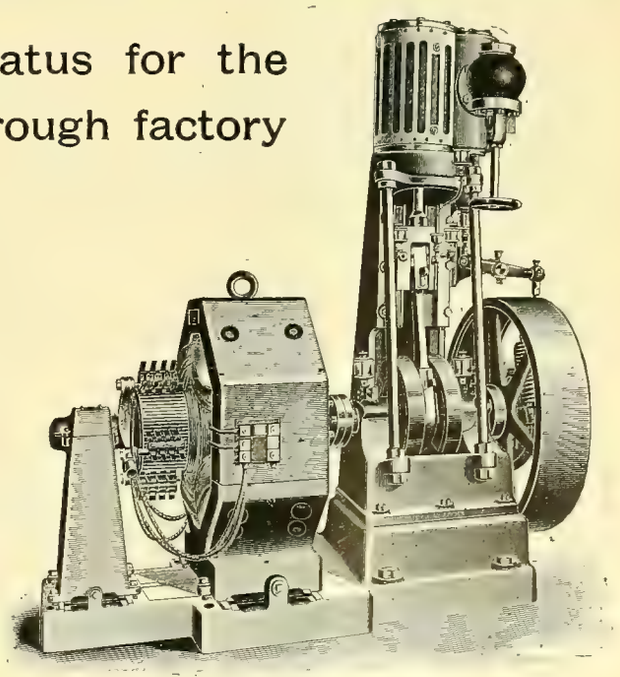

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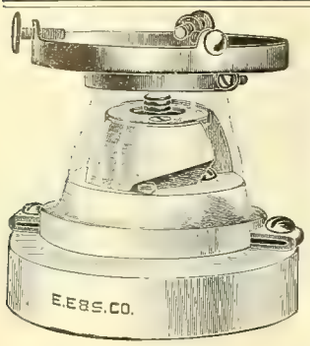


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Residence Arch. Rogers, Hyde Park-on-the-Hudson, N. Y.
Residence H. V. R. Kennedy, Hempstead, L. I.
Residence Hon. Whitelaw Reid, Ophir Farm, White Plains, N. Y.
Residence T. H. Pratt, Clinton, Ct.
Residence H. V. Parcell, Jr., Taylors on Schroon, N. Y.
Lewis Jones, Bristol, Pa.
Residence J. E. Hubinger, Stony Creek, Ct.
Residence G. W. Allen, "Elmwood," Long Meadow, Mass.
Theater, Guatemala, Central America.
Fort Monroe, Va.
*Being installed.

**C**arries the load in case of break down.
**H**elps the dynamo during heavy loads.
**L**owers the cost of operation.
**O**ften permits of a reduction in the size of the generating plant.
**R**educes the running time of the dynamo.
**I**ncreases the load factor.
**D**elivers current while the dynamo is shut down.
**E**qualizes the load on the generator.

## THE ELECTRIC STORAGE BATTERY CO.,

**Drexel Building, Philadelphia, Pa.**

# THE UPTON ARC LAMP

**For All Circuits.**

**The Cheapest to Buy, Use and Maintain.**

## Standard Thermometer Co.,

PEABODY, MASS.

The Original Manufacturers of the

*SIMPLEX, WARD and KNIGHT LAMPS*

CHARLES A. BRAMHALL, Selling Agent, 39 Cortlandt Street, NEW YORK.

# W. S. EDWARDS MFG. CO.,

MANUFACTURERS OF

## ELECTROLIERS.

**Combination Fixtures,**

**Electric and Combination Brackets.**

EXCLUSIVE DESIGNS. LOW PRICES.

**Have you received our New Catalogue, No. 5, of Electric Fixtures?**

If not, and you deal in Chandeliers, Brackets, etc., you should send for same.

**21 and 23 E. Lake St., - CHICAGO.**

# Practical Perfection Attained.

PERFECT INSULATION.

Highest Efficiency.

Splendid Regulation.

IT CANNOT BURN OUT.

**Our Guarantee:** We will **replace free of expense** to our customers any **Packard Transformer** that burns out under normal load.

We will also receive back and replace free of expense (or allow full credit for) any **Packard Transformer** that fails to give our customer entire satisfaction.

On the above basis we feel warranted in asking for a careful trial of the **Packard Transformer.**

It is to your interest as much as ours to take advantage of this, as we are offering you a Transformer superior to any other on the market, and one that **will save you money every hour it is in circuit.**

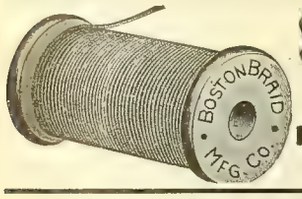
**We want to hear from you.**

## Electric Appliance Company,

**242 Madison Street, CHICAGO.**

**General Western Agents For the Packard Transformer.**

*ELECTRICAL SUPPLIES.*

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Ponder the pages of our book, mailed free.

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Two Wires in a Single Tube, the Standard Method of Electric Wiring.

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Manufacturer of Mast Arms, Pole and Swinging Hoods, House Brackets and other Specialties for Construction Work. — *Catalogues and Prices furnished on application.*

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For Arc Light and Trolley Cord.
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This system does not infringe the patents of the Bell Telephone or Western Electric Co. We build exchanges complete for local companies, or will install and operate exchanges ourselves at a low monthly rental. We keep in stock Blake transmitters and all kinds of supplies.

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We are the sole manufacturers of the P. & B. products which have been the STANDARD for ten years.
Send for samples and price lists.

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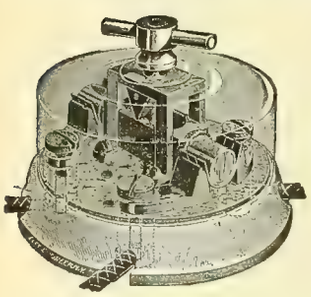

**MANY SWITCHES**
HAVE COME AND GONE, BUT THE
**NEW ENGLAND SWITCH**
IS STILL THE
**PEER OF ALL.**
TRY THEM AND WONDER WHY YOU EVER USED ANY OTHER.

**O. S. PLATT, - 88-102 Cannon St., Bridgeport, Conn.**

**CROSS ARMS, PINS AND BRACKETS.**

Why not use Yellow Pine Cross Arms?
We also manufacture Oak Pins and Brackets, and GENUINE BLACK LOCUST PINS.
We can ship promptly.
We guarantee our product equal to any in the market.
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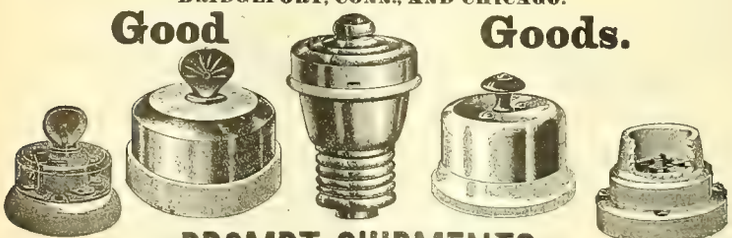

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☞ The R. Thomas & Sons Co. Porcelain is Good.

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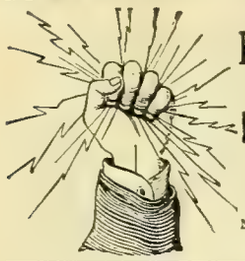

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Railway Feeder and Trolley Wire,
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
CABLES FOR AERIAL AND UNDERGROUND USE.

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CHICAGO STORE, F. E. Donohoe, 241 Madison St.
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## No. 11 DOUBLE GROOVE PONY INSULATOR.

**Can be Used for Transposing.**

The points or teats on the lower rim of the petticoat attracts the water on the outer surface of the insulator into drops. The water drops from these points on to the cross-arm, thereby preventing the moisture from creeping up on the inner petticoat, and thence to the pin. Owing to the great success of our Patent Teat Insulator in Telegraph Work, where the efficiency of the Insulator has proven to be more than twice that of the ordinary Insulator, we have concluded to apply the device to all Insulators for Telegraph, Telephone and Street Railway Work.

Standard Screw Glass Insulators,
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Colored Glass Insulators to designate different currents.
WORK ON SPECIAL DESIGNS A FEATURE.
Send Model or Drawing and we will furnish estimates.

## HEMINGRAY GLASS CO.,

Office, Covington, Ky. —ESTABLISHED 1848.— Factories, Muncie, Ind.

THE

# "CLARK" WIRE.

TRADE MARK.

For Switchboard, Railway and Motor use, we make all sizes of Stranded and Flexible Wire and Cables with Clark's Insulation.

The Clark Wire has been before the public and in use for the past nine years, and has met with universal favor. Thousands of miles of this wire have been sold, and are in use throughout the United States and Foreign Countries, and the demand for it is constantly increasing, because it always gives perfect satisfaction.

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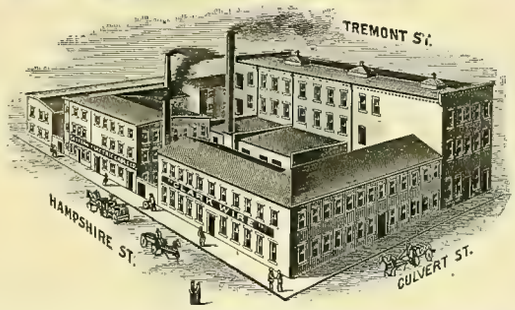


**In a Letter from the Inspector of the Boston Fire Underwriters' Union, he states: "A Thoroughly Reliable and Desirable Wire in every respect."**

The Rubber used in insulating our Wires and Cables is especially chemically prepared, and will not deteriorate, oxidize or crack, and will remain flexible in extreme cold weather, and is not affected by heat.

We guarantee our Insulation wherever used, Aerial, Underground or Submarine, and our net prices are as low, if not lower, than any other first-class Insulated Wire.

We shall be pleased to mail Catalogues with Terms and Discounts for Quantities.

## EASTERN ELECTRIC CABLE CO.,

61 and 63 Hampshire St., Boston, Mass.

HENRY A. CLARK, Treas. and Gen'l Mgr. HERBERT H. EUSTIS, Prest. and Electrician.

The Best on the market.
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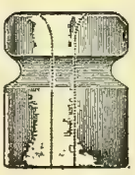
GENUINE HARD PORCELAIN, CUT-OUTS, SWITCH BASES, INSULATORS &c.



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Storage Batteries
FOR ALL PURPOSES,
Bradbury-Stone Electric Storage Co.,
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*(Stationary, Locomotive or Marine); Mechanics; Mechanical Drawing; Electricity; Architecture; Architectural Drawing and Designing; Masonry; Carpentry and Joinery; Ornamental and Structural Iron Work; Railroad Engineering; Bridge Engineering; Municipal Engineering; Plumbing and Heating; Coal and Metal Mining; Prospecting, and the English Branches.* Students make rapid progress in learning to Draw and Letter. The Steam Engineering course is intended to qualify engineers to secure Licenses. Send for free Circular, stating the subject you wish to study, to

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**FOR ELECTRICAL USES:**

**Graphite Rods of Various Lengths, from 1-5 Ohm to 100 Ohms Resistance to the inch. Graphite Boxes and Crucibles, Resisting Heats of 4,000 Degrees. Inquiries Gladly Answered.**

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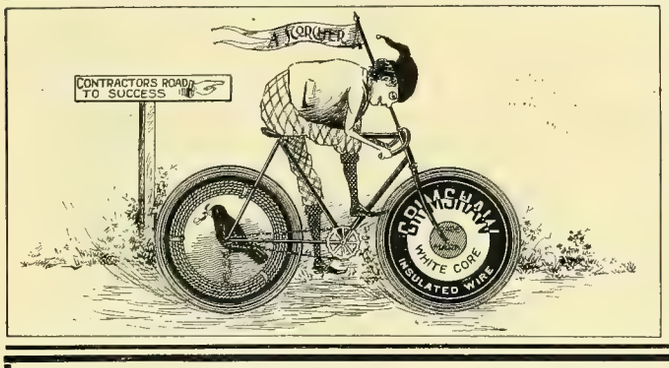


GRIMSHAW WHITE CORE. Used exclusively for all Incandescent Lighting at World's Columbian Exposition.

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COMPETITION LINE WIRE. Used by some of the largest Central Stations and Fire and Police Departments in the U.S.

GRIMSHAW TAPES, COMPETITION TAPES AND SPLICING COMPOUNDS.

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MAIN OFFICE: 13-17 Cortlandt St., New York.
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# ELECTRICAL SUPPLIES.

## WESTERN ELECTRIC COMPANY,

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WEATHER-PROOF
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"O.K."
LINE AND HOUSE WIRES

AGENCIES:

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# Phillips Insulated Wire Co.,

NEW YORK OFFICE: 39 and 41 Cortlandt St.
FACTORY: Pawtucket, R. I.

## POSITION WANTED.

As superintendent or carbon man of incandescent lamp factory, by a thoroughly competent man of several years' experience in these capacities, and with full theoretical knowledge of the work.

Address "CARBON,"
WESTERN ELECTRICIAN.

## WANTED.

Competent man to take charge of electrical repair shop. Must be thoroughly posted on armature winding and commutator work for all systems. Must have practical experience and know how to handle men so as to turn out work promptly and at lowest cost. References must be sent with application. A good opening with every opportunity for advancement to right party. Address "ARMATURE," care WESTERN ELECTRICIAN, 6 Lakeside Building, Chicago.

## WANTED.

By first-class firm, energetic traveling salesman, well acquainted with electric light stations, to sell article of regular and large consumption. State salary and references. "PROGRESS,"

Care WESTERN ELECTRICIAN,
6 Lakeside Bldg., Chicago.

# WANTED.

A first-class City Salesman to sell Electric Lighting Supplies; must be familiar with local (Chicago) business.

Address "Salesman,"
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6 Lakeside Building,
Chicago, Ill.

Endorsed by Board of Fire Underwriters.

SUPERIOR TO
COTTON WASTE.
Safe, Durable and Cheaper.

## RAW SILK MACHINERY WIPERS.

AMERICAN SILK MFG. CO.,
309 Walnut St., Philadelphia, Pa.

Agents wanted. Beware of loose woven imitations.

# Scrap Copper Wire WANTED.

It will pay the Electrical Plants to save their Scrap Copper Wire and ship to us in any quantity, at the following prices, f. o. b. Chicago, cash on receipt of same:

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| Bare Copper Trolley Wire | 9 cts. per lb. |
| Ordinary Bare Copper Wire Scrap | 8½ " " |
| Insulated Copper Wire | 5 to 8 " " |
| Heavy Red Scrap Brass | 7½ " " |
| Heavy Yellow Scrap Brass | 6¼ " " |
| Light Sheet Brass | 3¾ " " |

We receive metals in any quantity and send prompt returns. We also supply the Electrical trade with Cotton Waste, in bales of 100 and 500 lbs., also Babbitt, in lots of 100 lbs. and over, at the very lowest prices. It will pay you to correspond with us. Address

## Swarts Metal Refining Co.,

CHICAGO'S LEADING METAL HOUSE,

Established 1885. Incorporated 1895.
120-122 W. Lake St., CHICAGO, ILL.

Write for Illustrated Catalogue.

# FOR SALE, CHEAP!
## NEW 50 LIGHT
# Arc Dynamo.

This machine has never been used. In fact, has not yet been taken out of shop. Is of leading manufacture and will be guaranteed direct to purchaser by makers. Will be sold for one hundred dollars under market for cash.

Address **DYNAMO,**
WESTERN ELECTRICIAN OFFICE.

## A. CHISHOLM & CO.,

MANUFACTURERS OF

## Peerless Commutator Compound.

This Compound is sold on its merits.

No Electrical Plant can afford to be without it.

Lock Box 64,
**BAY CITY, MICH.**

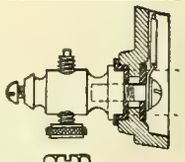
PEERLESS COMMUTATOR COMPOUND prevents heating, cutting and sparking. It has no equal as a commutator preserver. Used and indorsed by the largest and best electric plants in the country. Others imitate, but none equal the Peerless. Our name is on each stick. None other genuine.

AGENTS.

**For New England:** W. B. Southgate & Co., 146 Franklin St., Boston, Mass. **Middle States:** Bradford Belting Co., Cincinnati, O. **Pacific Coast:** Reger & Atwater, San Francisco, Cal. **Texas:** W. T. M. Mottram. **Detroit, Mich:** Commercial Electric Engineering Co. **London, Eng:** Robert W. Blackwell.

The Only Bells Made with these Improvements:

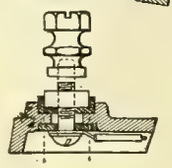
## Non-Turning, Binding and Contact Posts.



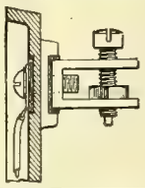
Style F, Pivoted Armature Iron Frame Bell.

Styles L R M, Iron Box Bells.

Styles E U G, Wood Box Bells.



Styles S A, Iron Frame Bells.



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Manufactured by

**Huebel & Manger,**
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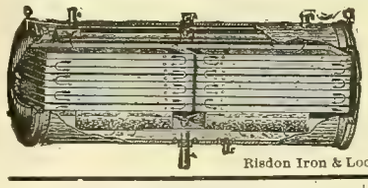
Procured. **30 Years' Practice.** **GRANT INSURED.** Pamphlet, references and advice **free.**

**CHAS. J. GOOCH,** Washington, D. C.

# Stilwell's Patent Live Steam-Feed Water Purifier.



**Removes all Impurities.**

Entirely prevents *scale* in Steam Boilers. Catalogue on application.

**The Stilwell-Bierce & Smith-Vaile Co.,**
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Risdon Iron & Loc'tive W'ks, San Francisco, Cal., Pacific Coast Agt.

## WOVEN WIRE BRUSHES.

The best Woven Wire Commutator Brush in the market is pat'd and manufactured by **The Belknap Motor Co., Portland, Me.**

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Telephone, Main 1096.

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## CHICAGO ELECTROTYPE & STEREOTYPE Co.

196 and 198 Clark Street, Chicago.

Fine Book and Catalogue Work a Specialty.

## Clark Electric Specialty Mfg. Co.,

28 S. Washington Ave., Minneapolis, Minn.,

MANUFACTURERS OF

**Switch Boards, Battery Boxes, Push Buttons, Rosette Mouldings, Etc.**

Correspondence solicited.

## Tickets at Reduced Rates

Will be sold via the Nickel Plate Road on occasion of the meeting of the German Catholic Societies of the United States at Albany, N. Y., September 15th to 18th. For further information address

J. Y. CALAHAN, Gen'l Agt.,
(89) 111 Adams St., Chicago.

ESTABLISHED 1857.

## WALLACE BARNES,

*Manufacturer of*

FLAT, COILED AND WIRE

## STEEL SPRINGS

OF EVERY DESCRIPTION

Send sample for prices. **Bristol, Conn**

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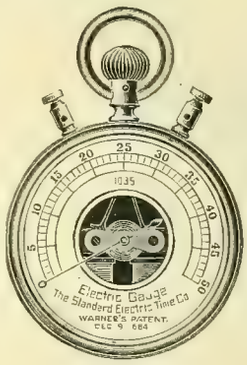
And circulars should not be sent out indiscriminately, to secure the best results. We make a specialty of classifying all trades and furnish the information in list form at reasonable rates, or address envelopes or wrappers from our lists.

Send for circular and price list.

**Mercantile Trade List Co.,**
601 Times Building, Pittsburg, Pa.

# THE ELECTRIC GAUGE.




For Testing Batteries and the Strength of Battery Currents.

The only convenient and practical instrument for the purpose. It is indispensable to those using batteries and having the care of them. The Pocket Gauge is the size of an ordinary watch, and is very convenient for the use of linemen, inspectors, etc. Price, $8.00. Call for WARNER'S PATENT ELECTRIC GAUGE. Manufactured only by

The Standard Electric Time Co., Waterbury, Conn.

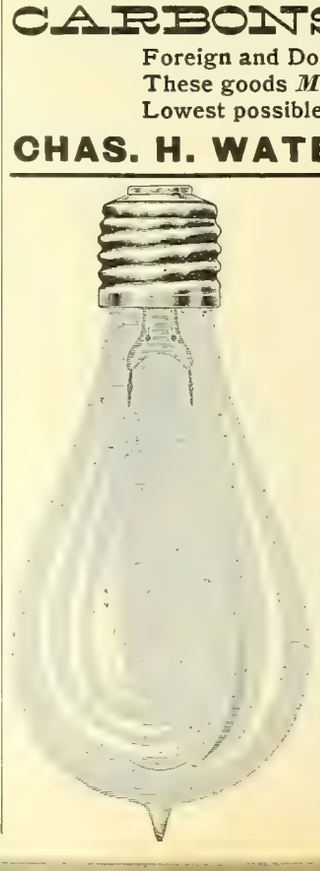
# THOUSANDS!!!
## OF ARC LAMPS,

High and Low Tension, Direct and Alternating, for all classes of work.

## CARBONS,

Foreign and Domestic, all of standard makes.
These goods *MUST BE SOLD* to close an estate.
Lowest possible prices. Write to

**CHAS. H. WATERMAN,** 1305 Havemeyer Building, 26 Cortlandt St., NEW YORK.



# BEACON

(ALL GLASS)

# Incandescent Lamp.

Unrivalled for long life, economy in current consumption and freedom from blackening.

Send for *new catalogue* of multiple series, miniature and decorative lamps.

## BEACON LAMP CO.,

BOSTON, MASS.

Irvington and Harcourt Sts,

## Notice to Contractors.

### Mt. Sterling, Ohio, Electric Light Plant.

SEALED proposals will be received by the Mayor and Council of the incorporated Village of Mt. Sterling, Madison county, Ohio, until 12 o'clock, noon, Tuesday, the 1st day of October, 1895, for furnishing all work and materials necessary for the construction of an Electric Light System for said village, as follows:

The machinery to be erected in the pumping station.

BID NO 1—ELECTRIC PLANT.

One Arc Dynamo -30- 2,000 C. P.
One Alternating Current Dynamo -30 to 35 K. W.—and Exciter.
All erected with foundations, belts, etc.
Also switchboard, and station wiring.
Arc Circuit—About 3.5 miles long.
Incandescent Circuit—About 3,000 ft.
Arc Lamps 21 in place, 2 extra.
Converters—Price for various sizes erected.

Proposal for one Alt. Current Dynamo for Arc and Incandescent Lamps and suitable Arc Lamps and accessories will be received.

BID NO. 2—STEAM PLANT.

One 80 H. P. Engine.
Two 5x16 ft. Boilers, with stack.
One 100 H. P. Heater.
One Boiler Pump.
One Injector.
Piping.
All complete with foundations, Boiler setting, and Pipe Covering.

Each proposal must be accompanied by cash, or a certified check for $300 00, made payable to John W. Hanawalt, Village Clerk, as a guarantee of good faith on the part of the bidders.

All proposals must be made on blanks furnished, and shall be sealed and addressed to John W. Hanawalt, clerk of said village, and endorsed, Proposal for Electric Light Plant.

So far as possible contractors shall employ home labor, and purchase material from home dealers, in the execution of the work.

Plans and specifications can be seen and blank forms of proposal obtained at the office of said clerk, after September 5, 1895.

Council reserves the right to reject any and all bids

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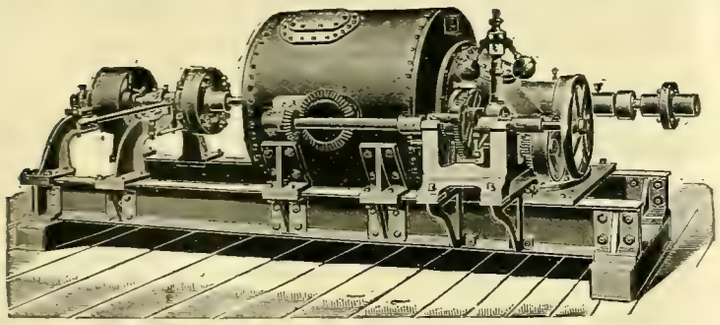

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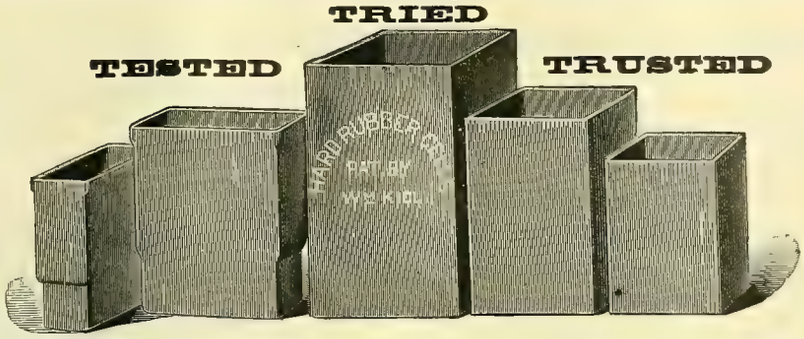


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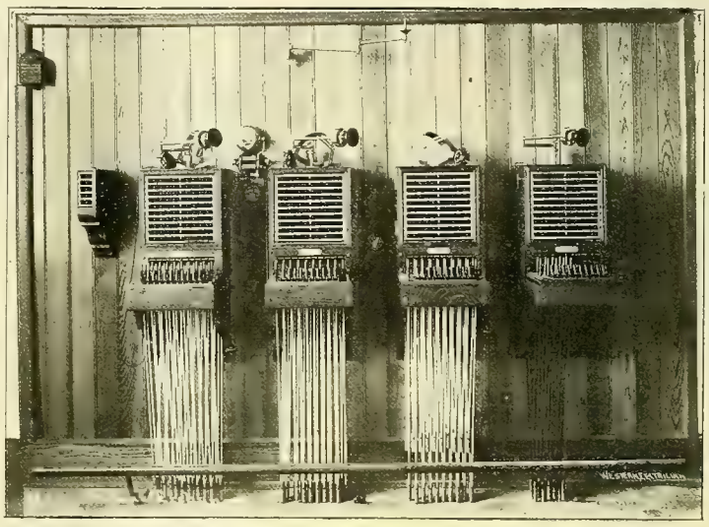

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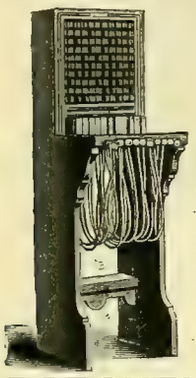

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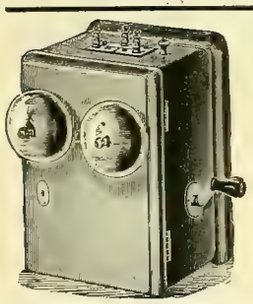

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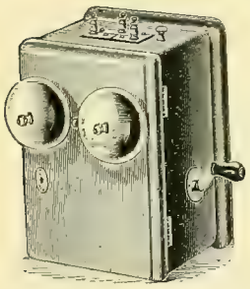

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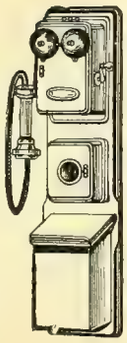

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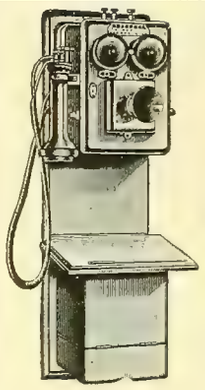

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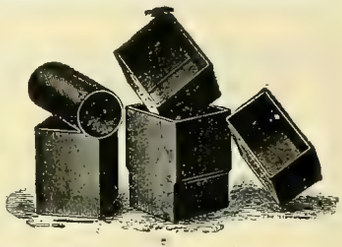

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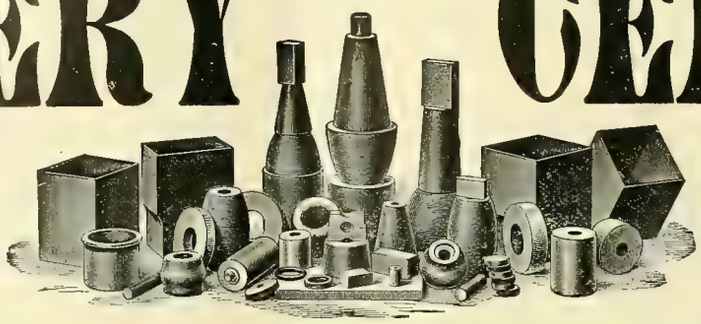

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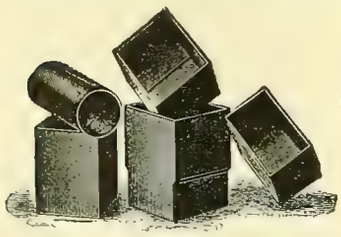

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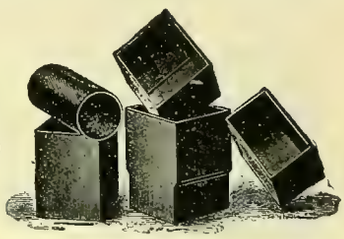

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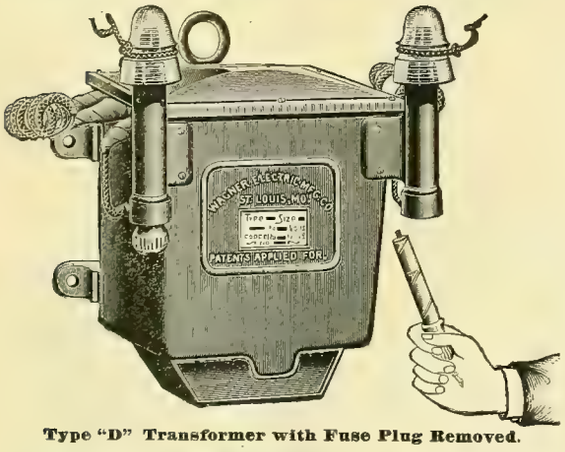

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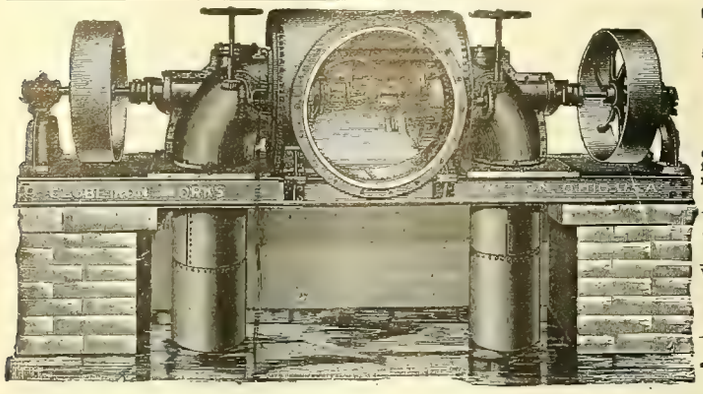

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| | Head. | Rev. per Min. | Cu. Ft. per Sec. | Horse Power. | P'r Cent |
|---|---|---|---|---|---|
| Whole Gate | 16.06 | 119.17 | 141.58 | 205.27 | 79 76 |
| ⅞ " | 16.42 | 122.00 | 127.18 | 195.19 | 82.58 |
| ¾ " | 16.78 | 117.33 | 112.60 | 175.74 | 82.18 |
| ⅝ " | 17.03 | 111.83 | 98.12 | 149.99 | 79.31 |
| ½ " | 16.88 | 118.67 | 82.07 | 118.40 | 75.52 |

**Test of a 42-inch Wheel—July 14, 1894.**

| | Head. | Rev. per Min. | Cu. Ft. per Sec. | Horse Power. | P'r Cent |
|---|---|---|---|---|---|
| Whole Gate | 16.33 | 128.00 | 134.18 | 199.56 | 80.50 |
| ⅞ " | 16.66 | 134.80 | 120.85 | 188.14 | 83.09 |
| ¾ " | 16.59 | 129.33 | 104.85 | 162.89 | 82.77 |
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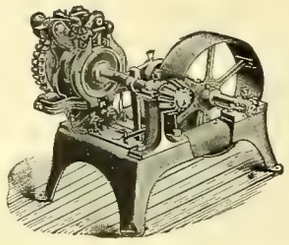

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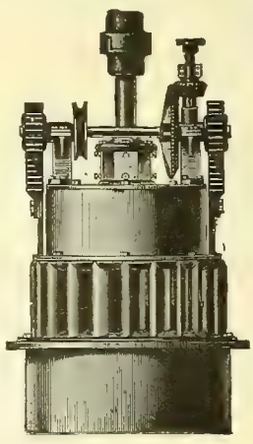

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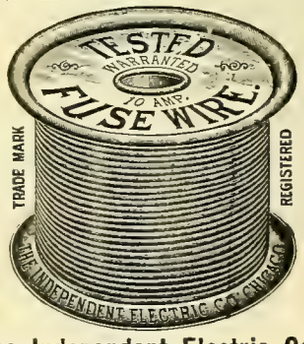


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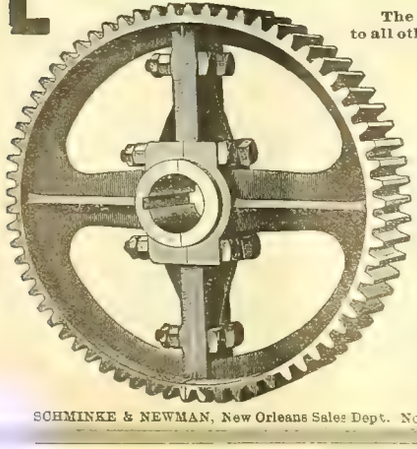

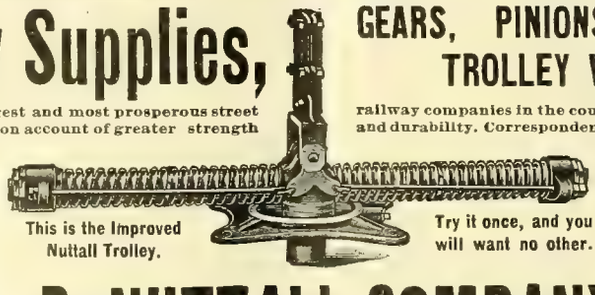

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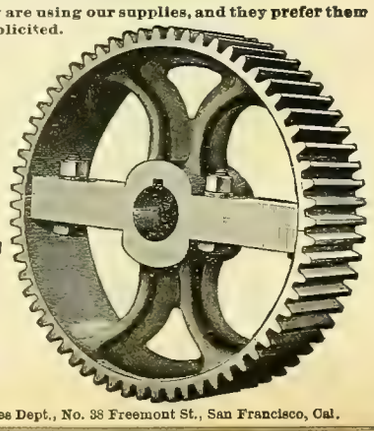

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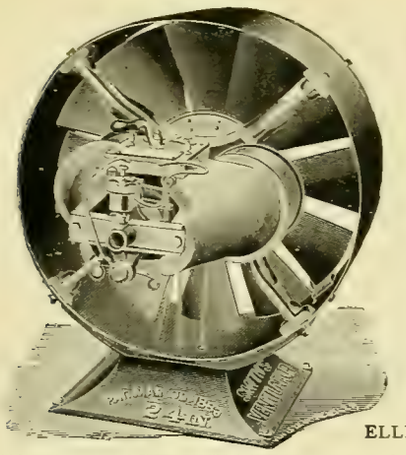

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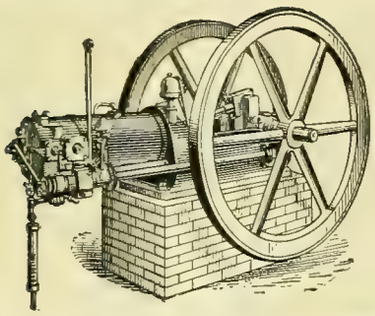

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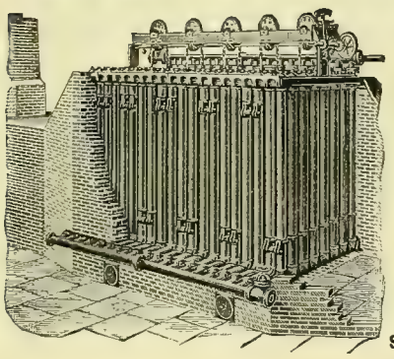

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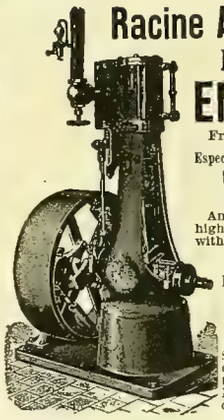

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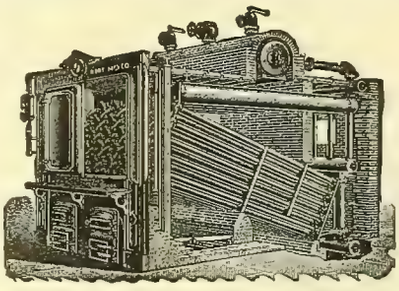

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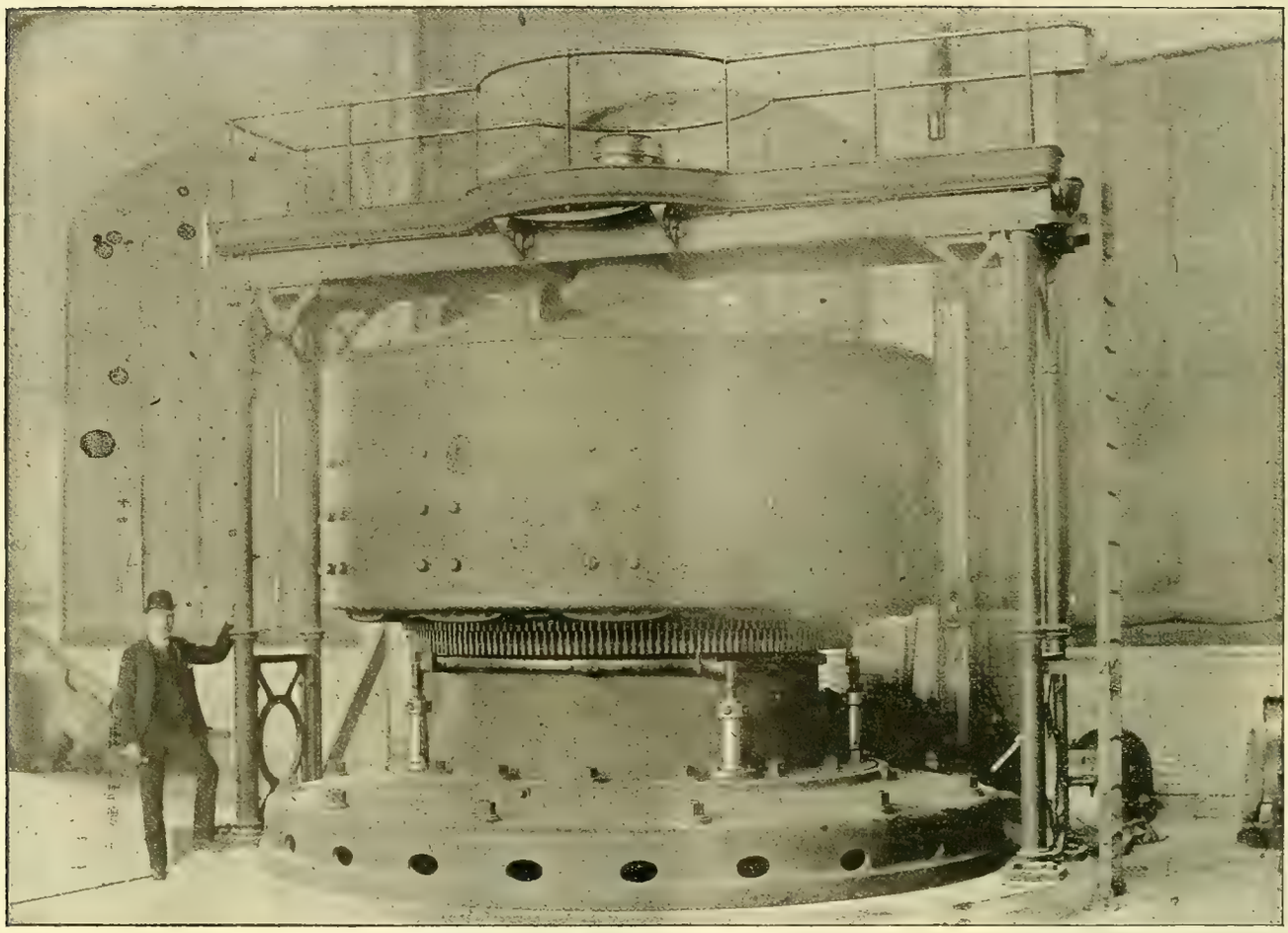

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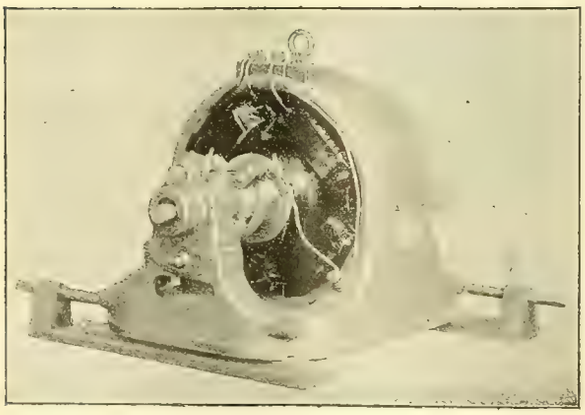

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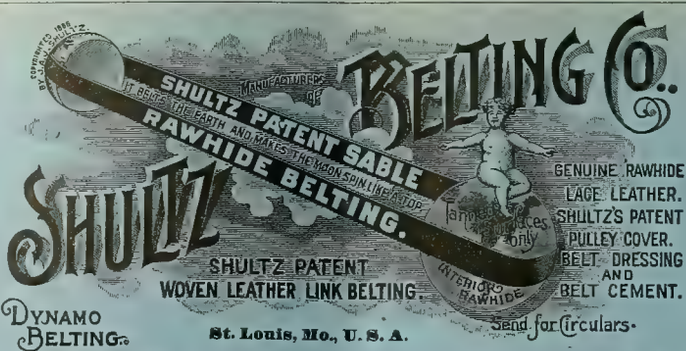


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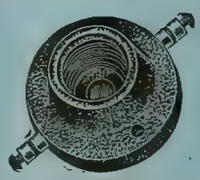

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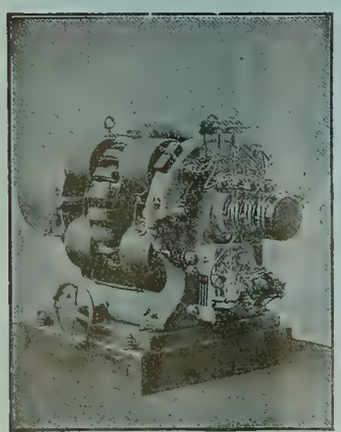

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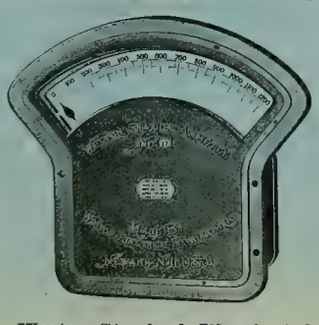

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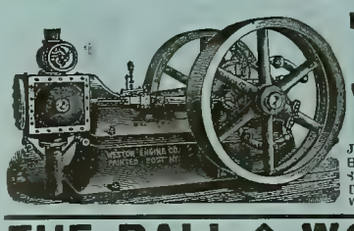

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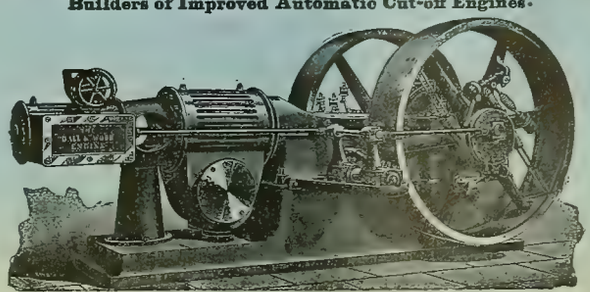

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Elec. Engr. & Supply Co.
Electric Protection Co.
Farr Tel. & Const. Supply Co.
Forest City Elec. Wks.
General Electric Co.
Interior Conduit & Ins. Co.
Louisville Elec. Wks.
MacCurdy & Smith.
Metropolitan Electric Co.
Mianus Electric Co.
Partrick & Carter Co.
Peru Elec. Mfg. Co.
Platt, O. S.
Queen & Co. Inc.
Sioux City Brass Works.
S. K. C. Specialty Co.
Solar Electric Co.
Standard Tel. & Elec. Co.

**Globes and Electrical Glassware.**
Edgerton Pottery Co.
Edwards, W. S. Mfg. Co.
Hemingray Glass Co
Peru Elec. Mfg. Co.
White Mfg. Co.

**Graphite Specialties.**
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.

**Hard Rubber Goods.**
Butler Hard Rubber Co.
Fiberite Co.. The.
Newton Rubber Wks.

**Insulators and Insulating Materials.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Brixey, W. R.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Central Electric Co.
Chisholm & Co., A.
Crocker-Wheeler Elec. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Empire China Works.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Hart & Hegeman Mfg. Co.
Hemingray Glass Co.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Louisville Elec. Wks.
MacCurdy & Smith.
Munsell & Co., Eugene.
National India Rubber Co.
Newton Rubber Wks.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Partrick & Carter Co.
Peru Elec. Mfg. Co.
Phillips Insulated Wire Co.
Platt, O. S.
Simplex Electrical Co.
Standard Paint Co.
Standard Underground C.Co.

**Insulated Wires and Cables—Magnet Wire.**
American Electrical Works.
Brixey, W. R.
Bunnell & Co.. J. H.
Central Electric Co.
Eastern Electric Cable Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
General Electric Co.
Independent Electric Co.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C.Co.

**Lamps, Incandescent.**
Am. Electrical Mfg. Co.
Beacon Lamp Co.
Buckeye Electric Co.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Globe Electric Light Co.
New York & Ohio Co.
Partrick & Carter Co.
United Elec. Imp. Co.
Westinghouse Elec.&Mfg Co.

**Lightning Arresters.**
Colgate Co , Geo. L.
Diamond Electric Co.
Electric Appliance Co.
General Electric Co.

**Machinery Wipers.**
Am. Silk Mfg. Co.

**Magnet Wire.**
(See Insulated Wires.)

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Harrington, Son & Co., E.
Lukens Iron & Steel Co.
Manistee Iron Wks. Co.

**Mica.**
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General Electric Co.

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Card Electric Co.
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Crocker-Wheeler Elec. Co
Eddy Elec. Mfg. Co.
Elec. Engr. & Supply Co.
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General Electric Co.
Hartley Elec. Wks.
Interior Conduit & Ins. Co
Quaker City Elec. Co.
Roth Bros. & Co.
Royal Electric Co.
Sioux City Brass Works
Standard Electric Co.
Stanley Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
Walker Mfg. Co.
Westinghouse El. & Mfg Co.

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Garlock Packing Co.

**Paints.**
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Standard Paint Co.

**Phosphor Bronze.**
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Valentine-Clark Co.

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General Electric Co.
Hemingray Glass Co.
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Electrician Publishing Co

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Electric Appliance Co
Partrick & Carter Co.

**Rheostats.**
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General Electric Co.
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**Sal Ammoniac.**
Klipstein & Co., A.

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Boston Braid Mfg. Co.

**Speaking Tubes.**
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Electric Appliance Co.
Ostrander & Co., W. R.
Partrick & Carter Co.

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Colgate Co., Geo. L.
Diamond Electric Co.
Queen & Co. Inc.
Weston Electrical Inst. Co
Whitney Elec. Inst. Co.

**Springs.**
Barnes, Wallace.

**Steam Heating.**
Goubert Mfg. Co.
Webster & Co., Warren.

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Electric Storage Battery Co.
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Pumpelley-Sorley S. B. Co.

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Brill, J. G. Co.

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Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co
Okonite Co., The.
Simplex Electrical Co.
Standard Paint Co.

**Telegraph Apparatus**
Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

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Central Electric Co.
Farr Tel. & Const. Supply Co
Forsyth & Fisk.
Gustafson, W. A.
Keystone Telephone Co.
McEvoy, C. H.
Mianus Electric Co.
Mo. Telephone Mfg. Co.
Phila. Telephone Co.
Public Telephone Co.
Standard Tel. & Elec. Co.
U. S. Tel. Const. Co.
Western Electric Co.
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Can meet your desire for Style and Price.

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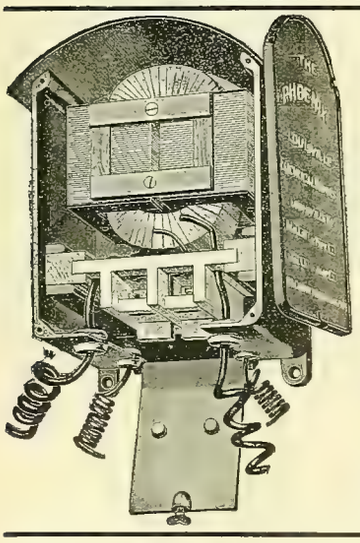

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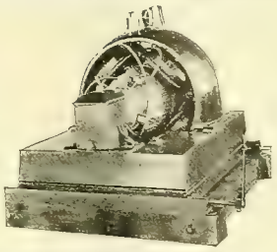

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Reversible Motors and Controllers for Rolling Mills, Bridges and Traveling Cranes.

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"Interior Conduit had to fight its way, to overcome criticism and opposition; but to-day it has the endorsement of the underwriting bodies of America, and is being rapidly introduced all over Europe."—*Electrical Engineer.*

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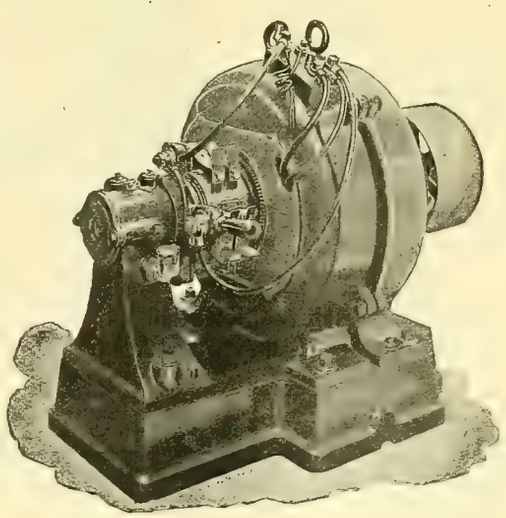
there must be a printing office, or laundry, machine shop, or some user of light power that would be glad to displace an unsatisfactory, unsafe and unclean engine and boiler combination with a **Lundell Motor,** if they only knew how easily they could do it.

**Have you told them?** Get Smith to put in a motor. And Jones, and Greene, and Brown, and Smythe will not rest until they have one too. It's infectious. You'll be busy.



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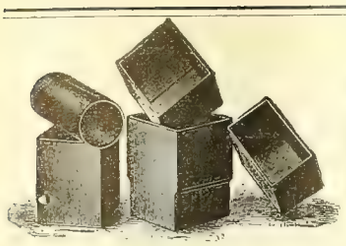
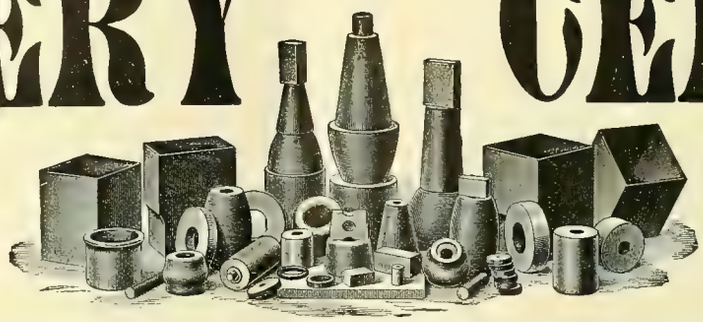


# THE FREEMAN

# BATTERY CELLS.

Estimates Furnished on Application. Prompt Delivery.



Standard Sizes Always on Hand.

The composition used in the manufacture of these battery cells makes them positively acid-proof, which result has never before been accomplished, providing additional strength to such an extent that this cell can be used where no other would be practical.

## THESE CELLS ARE A NEW PRODUCTION AND FULLY GUARANTEED.

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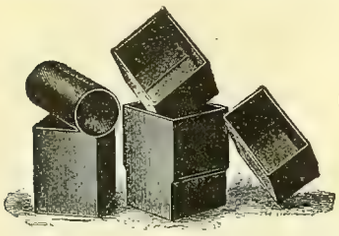

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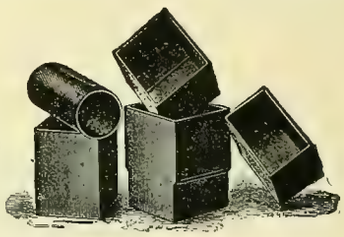
J. Frank Dunbar, Treasurer, **NEWTON RUBBER CO.,**

87 Summer St., Boston Mass.



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## The Helios Electric Company claims:

That they have more alternating arc lamps in use than all other makes combined.
They guarantee 80 per cent. more available light than is obtained from any other alternating arc lamp.
They guarantee to give as much light as any direct current lamp using the same number of watts.

# SPENCER'S IMPROVED ALTERNATING ARC LAMP

## Possesses the following advantages:

Minimum choke in the regulating coil.
Practically no energy absorbed in the regulating device.
Durability of all its parts; not liable to get out of order.
Can be used successfully on all periods.
Starts quickly.

# SPENCER'S DIRECT CURRENT CONSTANT POTENTIAL LAMP.

## Guaranteed not to see-saw.

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## USE THE BOUDREAUX DYNAMO BRUSH.

The Boudreaux Dynamo Brush Co. NO GAUZE.

The Boudreaux Dynamo Brush Co. NO CARBON.

NO SPARKING. NO CUTTING.

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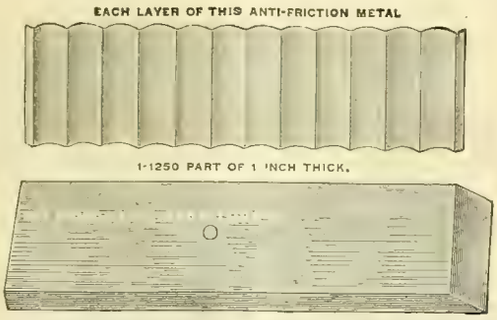


The Boudreaux Dynamo Brush Co. NO WOVEN WIRE.

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**THE BOUDREAUX DYNAMO BRUSH CO.,**

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These Switches are second to none. They are fire and damp proof. Mechanism is simplicity itself. Nothing to get out of order. Make and break so wide that no arc can form. Wired without removing casing. Buttons made of mother of pearl. Base made of vulcabeston with porcelain cases.

☞ PARTICULAR ATTENTION IS CALLED TO OUR NEW DOUBLE POLE SWITCH.

Write for price list and discount.

**THE ELECTRIC PROTECTION COMPANY,**

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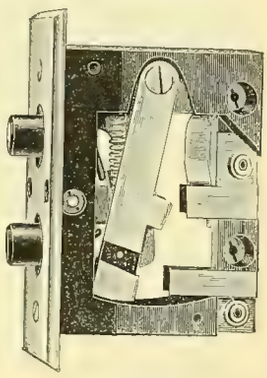

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QUALITY UNEQUALED.

FACTORY PRODUCTION TRIPLED.

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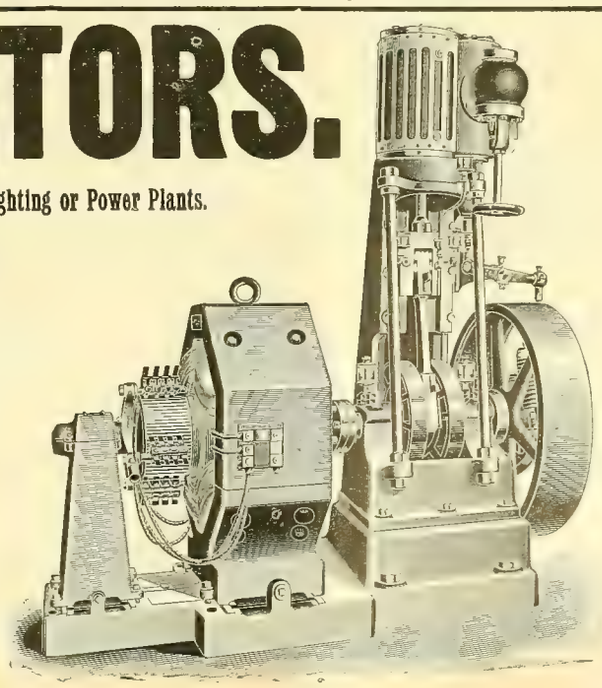

Direct Connected or Belted for Electric Railways, Central Stations, Isolated Lighting or Power Plants.

## EDDY MOTORS—SLOW, MEDIUM OR HIGH SPEED.

*We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.*

## THE EDDY ELECTRIC MFG. CO.,

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WE MANUFACTURE THE "GLOBE." LIFE AND EFFICIENCY GUARANTEED.

New Process of Exhaustion by Mechanical Vacuum Pump. Absolutely Dry Vacuum. Samples and Prices Furnished on Application. Correspondence Solicited.

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AGENTS WANTED. WRITE US.

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OFFICE AND WORKS:

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New Discounts on Standard Series Incandescent Lamps For all Systems and for any Current, Candle-Power or Base.

TRIAL ORDER SOLICITED.

**Alternating Current Generators, Transformers, Motors, Arc Lamps and Switchboard Equipment for Central Stations.**

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CORRESPONDENCE SOLICITED. SATISFACTION GUARANTEED

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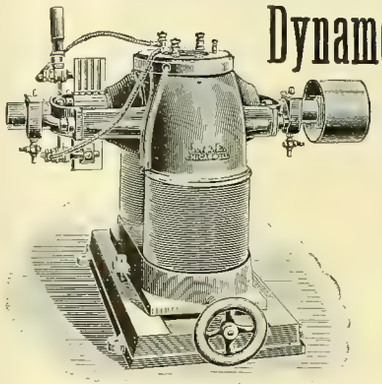

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Manufactured by

**ROTH BROS. & CO.,**

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**DYNAMOS,**
**8 to 75 Light Capacity.**
**ELECTRIC MOTORS,**
**1-8 to 7 Horse Power.**

High Efficiency, Best Material, Perfect Regulation, Low Prices.

Complete Plants Installed.

Special attention given to Dynamos and Motors for Storage Battery use.

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## Subscribe for the Western Electrician.

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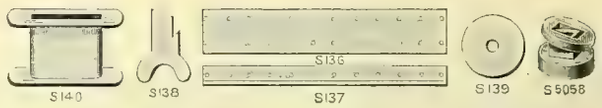


All Controllers are Insulated with Vulcabeston.

*G. E. 800 and Westinghouse Commutator Rings, Brush Holder Bushings and Field Spools.*

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Moulded Mica Trolley Insulating Materials, Frogs, Crossings, Tree Insulators, Weatherproof Sockets, etc.

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MANUFACTURERS OF THE

# "ROYAL ALTERNATOR."

No Commutator! No Moving Wire! Efficiency High! Regulation Close! Fully Guaranteed!

TRANSFORMERS OF ANY DESCRIPTION. DIRECT CURRENT GENERATORS AND MOTORS.

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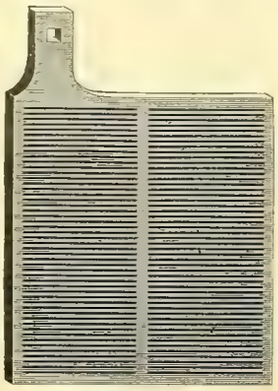
# STORAGE BATTERIES.

UNFORMED PLATE.

Our Plate is made from one integral piece of rolled virgin lead, without joints, solder or applied active material or paste. After being prepared by sawing it is put through an electro-chemical process by means of which the interstices become completely filled with oxide of lead

## FORMED FROM THE PLATE ITSELF,

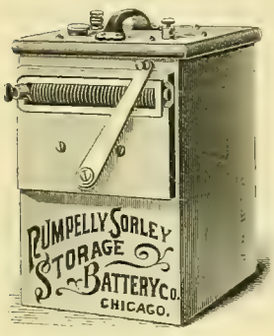


FORMED PLATE.

it thus having the same chemical purity as the Plate or supporting grid. Under the above method of manufacture, fully protected by our patents, we have produced the

## FIRST INTEGRAL SLOTTED ROLLED LEAD

Storage Battery Plate, and one which has shown a marked advantage in efficiency and life over any form of cast lead or grid.

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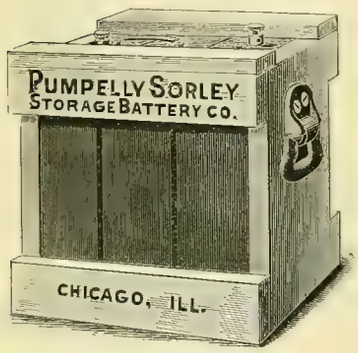
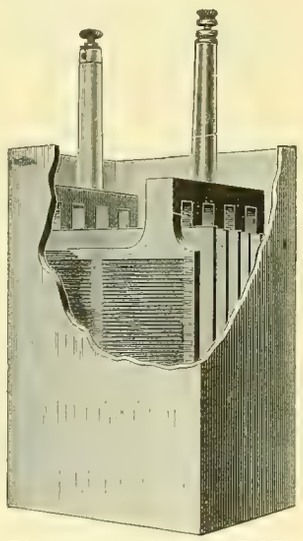
Our Portable Phonograph and Physician's Cells have almost completely displaced all other types of Batteries in the West.




BOAT CABINET.

Our Portable Electric Boat Outfits are in use by many sportsmen, tourists and pleasure seekers.



INTERIOR OF PORTABLE CELL.

TELEPHONE CABINET.

Our **Telephone Cabinets** are used extensively by the **Chicago Telephone Co.** and others, and our small telephone cabinets are rapidly displacing primary batteries in telephone service. Our central station cells are used in many Western plants, and are now being installed in the **Chicago Board of Trade,** and the best evidence of our success in our own territory lies in the fact that **threatenings of injunctions** are beginning to be made to our customers. But we wish to assure them that we not only own all patents covering the manufacture of our own battery, but **control the use of Asbestos, Cellulose or wood pulp fibre between** the plates of storage batteries, and **will protect our customers against all suits for infringement.**

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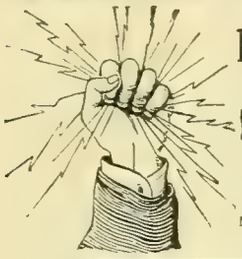

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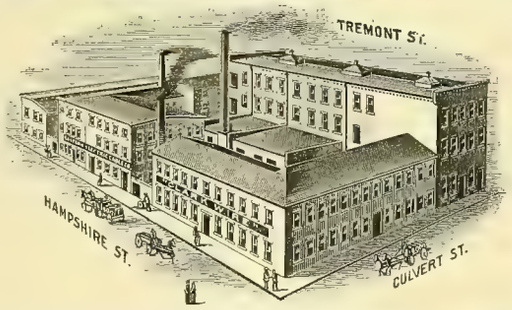


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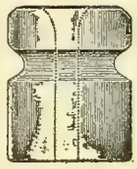

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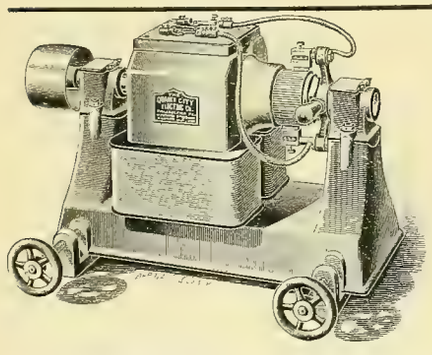

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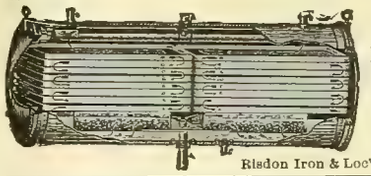

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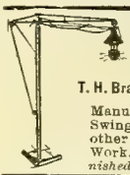

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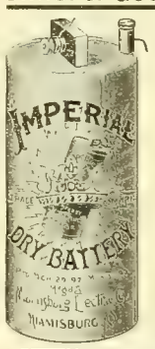


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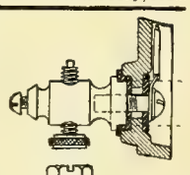

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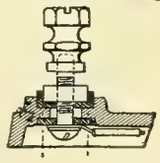

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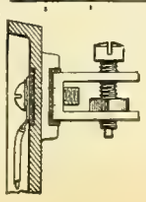

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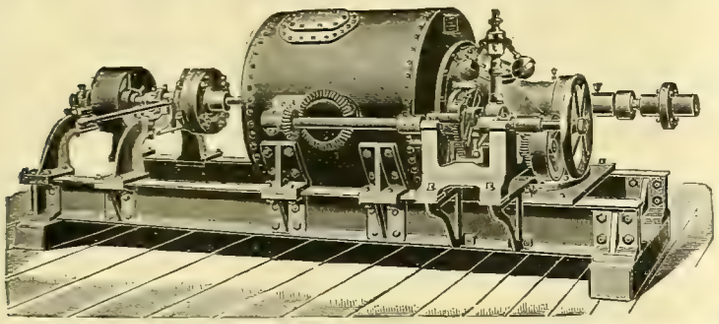

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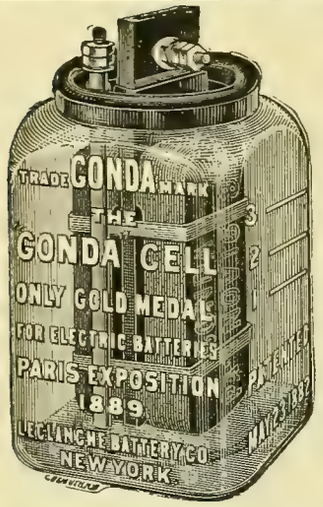


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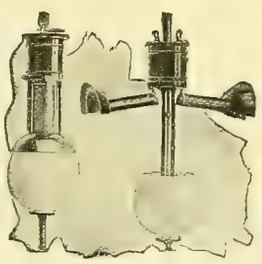

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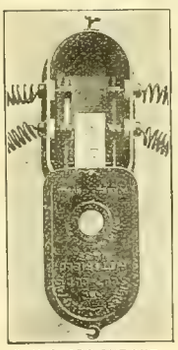

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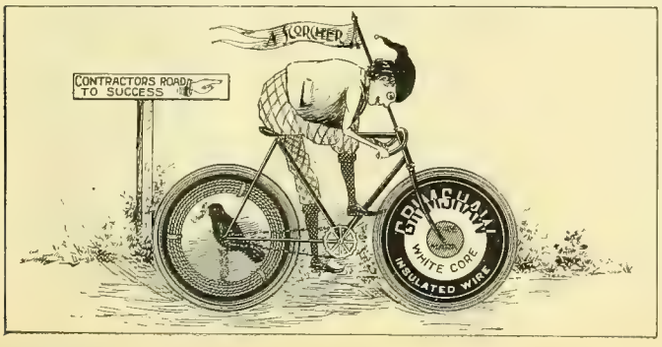


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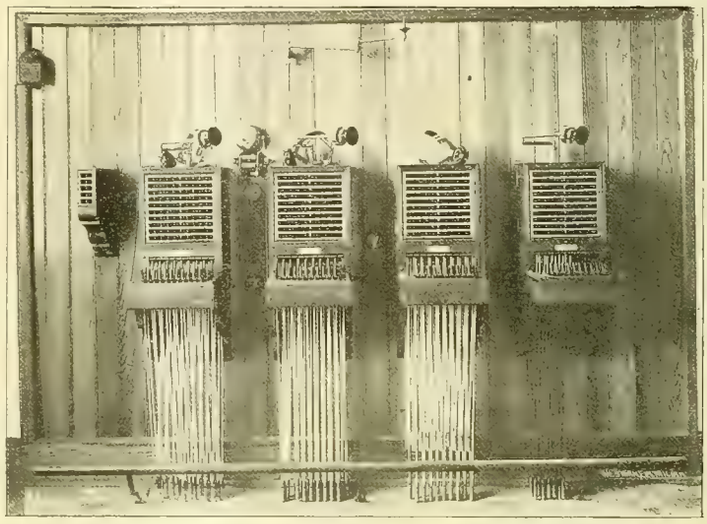

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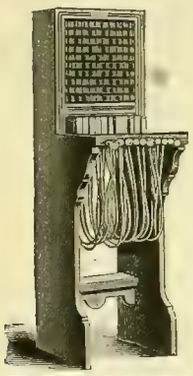

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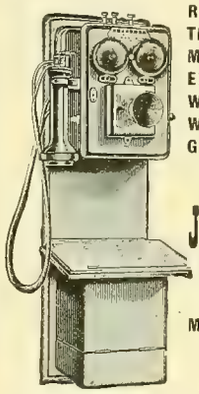

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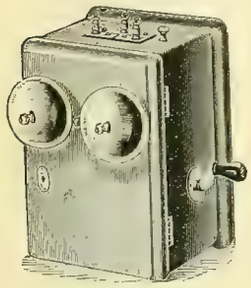

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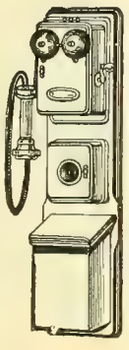

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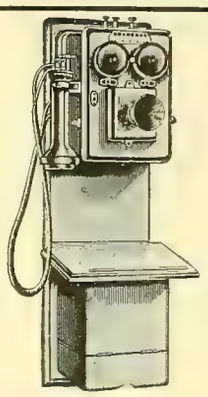

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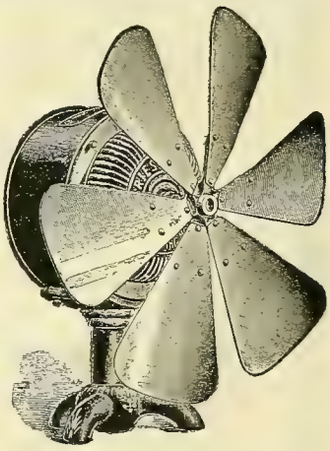

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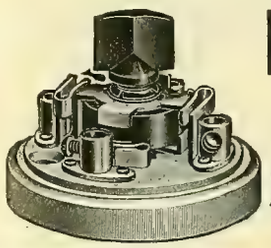

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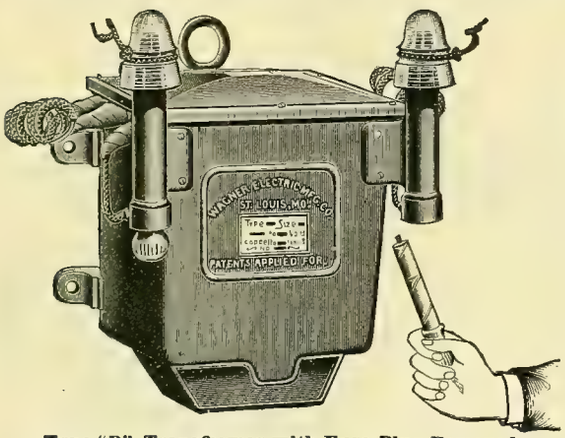


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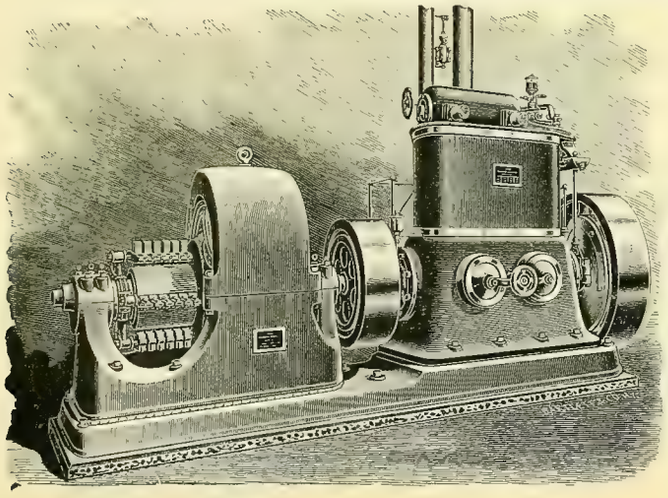

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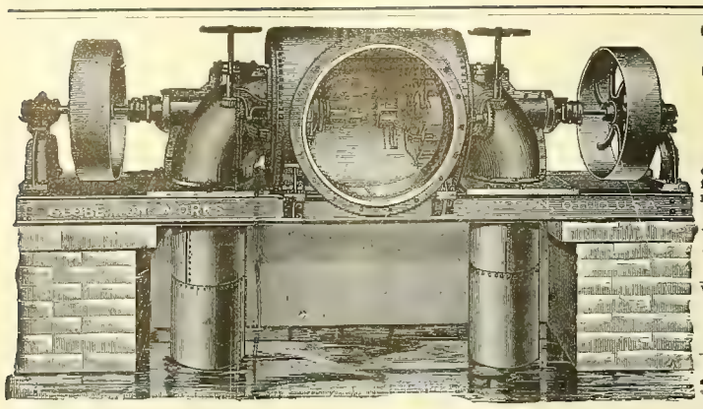

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| | Head. | Rev. per Min. | Cu. Ft. per Sec. | Horse Power. | P'r Cent |
|---|---|---|---|---|---|
| Whole Gate | 16.06 | 119.17 | 141.58 | 205.27 | 79 76 |
| ⅞ " | 16.42 | 122.00 | 127.18 | 195.19 | 82.58 |
| ¾ " | 16.78 | 117.33 | 112.60 | 175.74 | 82.18 |
| ⅝ " | 17.03 | 111.83 | 98.12 | 149.99 | 79.31 |
| ½ " | 16.88 | 118.67 | 82.07 | 118.40 | 75.52 |

**Test of a 42-inch Wheel - July 14, 1894.**

| | Head. | Rev. per Min. | Cu. Ft. per Sec. | Horse Power. | P'r Cent |
|---|---|---|---|---|---|
| Whole Gate | 16.33 | 128.00 | 134.18 | 199.66 | 80.50 |
| ⅞ " | 16.56 | 134.80 | 120.85 | 188.14 | 83.09 |
| ¾ " | 16.59 | 129.33 | 104.85 | 162.89 | 82.77 |
| ⅝ " | 17.13 | 125.25 | 92 76 | 142.40 | 79.21 |
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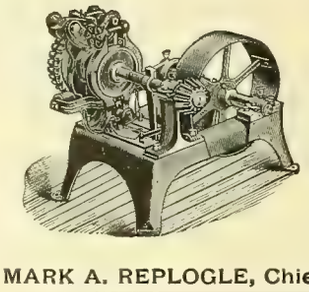

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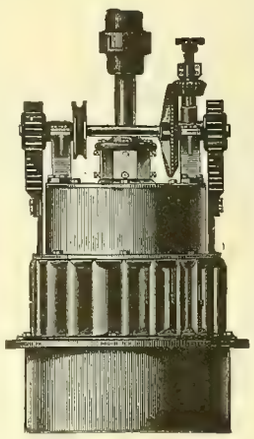

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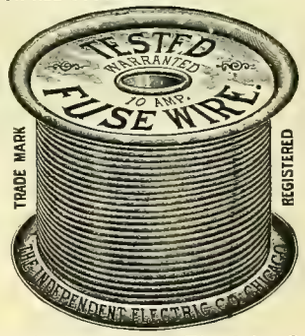


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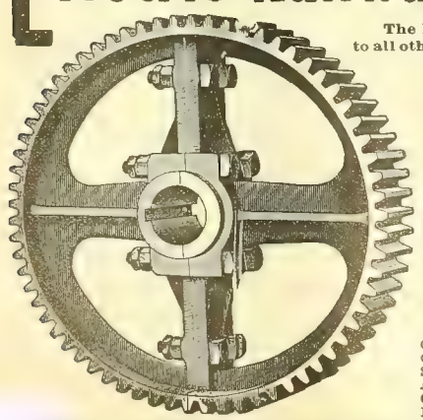

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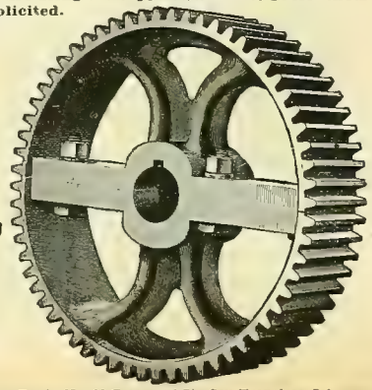

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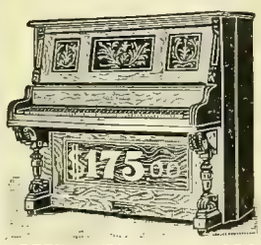

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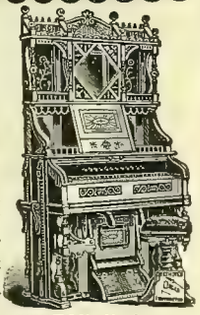

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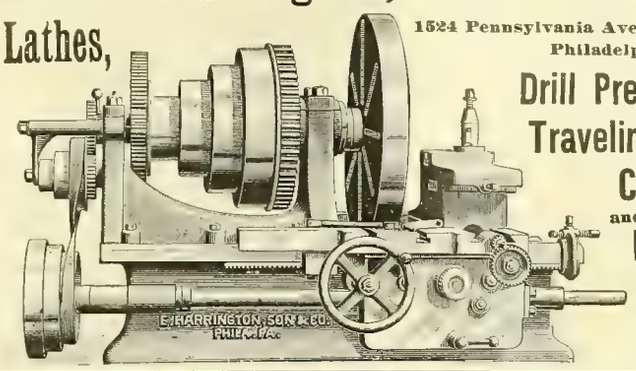


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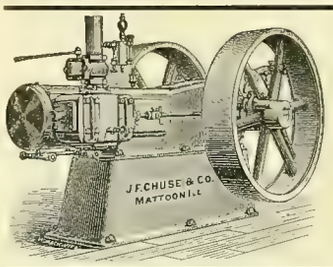


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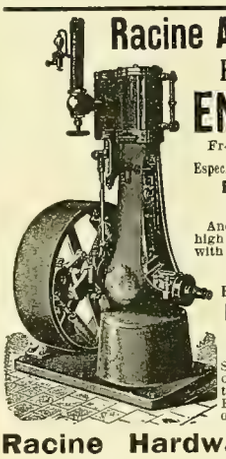

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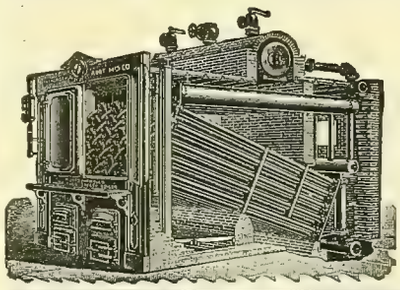

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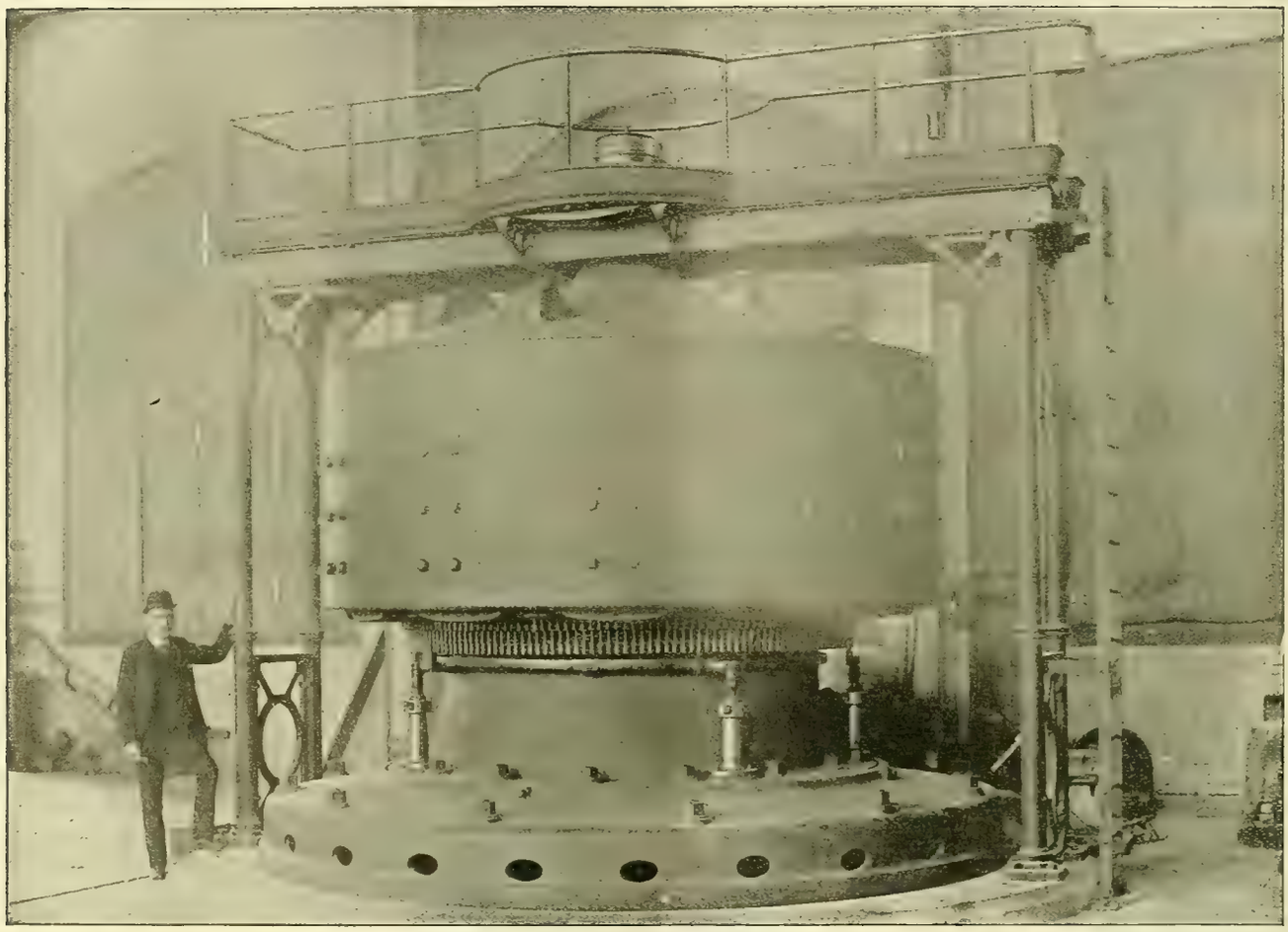

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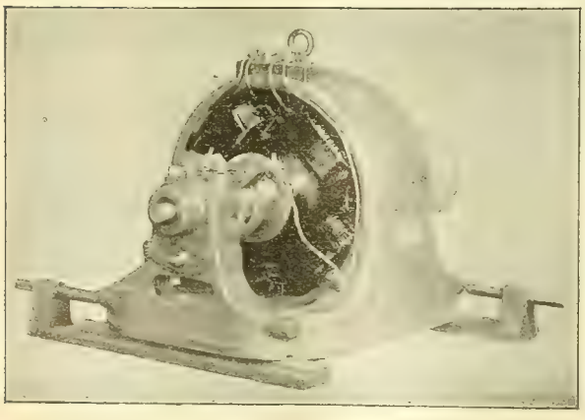

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"The results of the tests are given in the attached table.

| Number. | Watts Capacity. | Open Circuit Current. | | Watts Iron Loss. | | Watts Copper Loss Full Load. | Total Pressure Drop. | Efficiencies. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Full Load. | | All Day. | |
| | | *f* 125 | *f*-60 | *f*-125 | *f*-60 | | | *f*-125 | *f*-60 | *f*-125 | *f*-60 |
| 1 | 1250 | .043 | .066 | 37 | 48 | 30 | 2.5 | 95 | 94 | 85 | 83 |
| 2 | 1500 | .076 | .124 | 50 | 71 | 45 | 3.5 | 95 | 94 | 85 | 81 |
| 3 | 1500 | .052 | .100 | 32 | 46 | 38 | 4.0 | 96 | 95 | 89 | 85 |
| 4 | 2500 | .230 | .540 | 135 | 230 | 44 | 2.5 | 92 | 89 | 77 | 68 |
| 5 | 1800 | .076 | .600 | 53 | 109 | 67 | 5.0 | 94 | 92 | 85 | 75 |
| 6 | 2000 | .055 | .091 | 42 | 56 | 55 | 5.0 | 95 | 94 | 89 | 86 |
| 7 | 1000 | .028 | .064 | 24 | 28 | 53 | 3.0 | 95 | 94 | 87 | 86 |
| 8 | 1500 | .073 | .113 | 57 | 76 | 31 | 2.5 | 94 | 93 | 83 | 79 |
| 9 | 1500 | .077 | .144 | 43 | 55 | 28 | 3.0 | 95 | 95 | 86 | 84 |

**"These results, I find, do not differ very widely from those published by the Fort Wayne "Electric Corporation in a small blue-printed pamphlet, which, however, contains tests made "by the company upon only a few of the makes of transformers included in my table."**

**The transformer marked No. 1 in the above table, is a twenty-five light transformer of the Fort Wayne Electric Corporation's make.**

*Abstract from a paper read before the Northwestern Electrical Association at the summer meeting, held in Chicago, July 17, 18 and 19.


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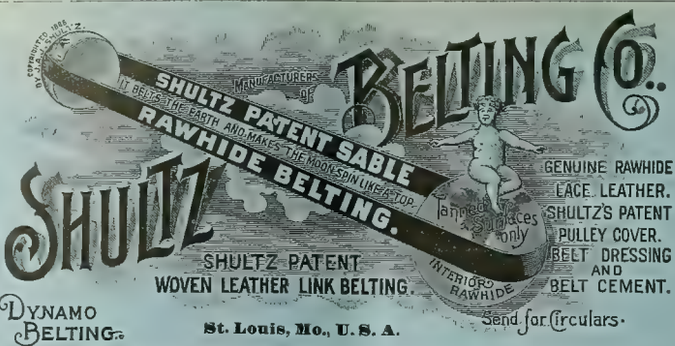


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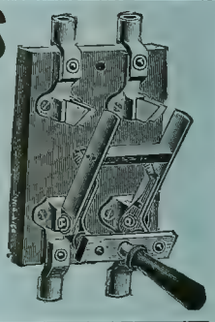

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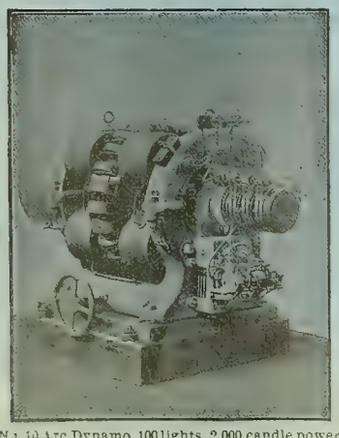

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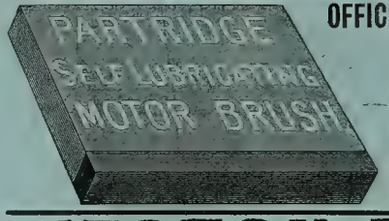


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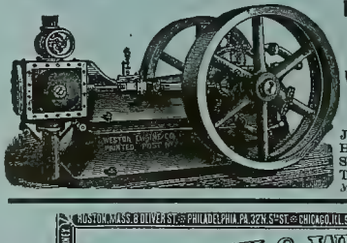

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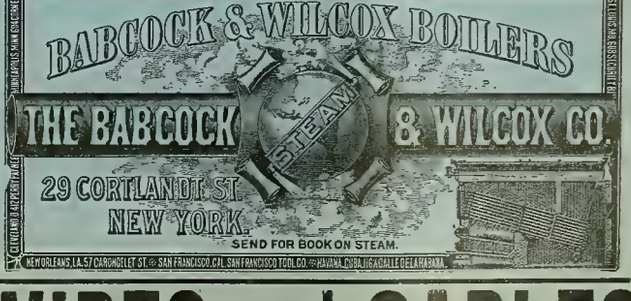


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Munsell & Co., Eugene.
National India Rubber Co.
Newton Rubber Wks.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Partrick & Carter Co.
Peru Elec. Mfg. Co.
Phillips Insulated Wire Co.
Platt, O. S.
Simplex Electrical Co.
Standard Paint Co.
Standard Underground C.Co.

**Insulated Wires and Cables—Magnet Wire.**
American Electrical Works.
Brixey, W. R.
Bunnell & Co., J. H.
Central Electric Co.
Eastern Electric Cable Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
General Electric Co.
Independent Electric Co.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C.Co.

**Lamps, Incandescent.**
Am. Electrical Mfg. Co.
Beacon Lamp Co.
Buckeye Electric Co.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Globe Electric Light Co.
New York & Onio Co.
Partrick & Carter Co.
United Elec. Imp. Co.
Westinghouse Elec. & Mfg Co.

**Lightning Arresters.**
Colgate Co, Geo. L.
Diamond Electric Co.
Electric Appliance Co.
General Electric Co.

**Machine Wipers.**
Am. Silk Mfg. Co.

**Magnet Wire.**
(See Insulated Wires.)

**Mechanical Machinery**
Besly & Co., Chas. H.
Harrington, Son & Co., E.
Lukens Iron & Steel Co.
Manistee Iron Wks. Co.

**Mica.**
Johns Mfg. Co., H. W.
Munsell & Co. Eugene.

**Mining Apparatus, Elec.**
General Electric Co.
Independent Electric Co.

**Motors.**
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Belknap Motor Co.
Brush Electric Co.
Card Electric Co.
Central Electric Co.
Colburn El. Mfg. Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Elec. Engr. & Supply Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hartley Elec. Wks.
Interior Conduit & Ins. Co.
Quaker City Elec. Co.
Roth Bros. & Co.
Royal Electric Co.
Sioux City Brass Works.
Standard Electric Co.
Stanley Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
Walker Mfg. Co.
Westinghouse El. & Mfg Co.

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Garlock Packing Co.

**Paints.**
MacCurdy & Smith
Standard Paint Co.

**Phosphor Bronze.**
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Beethoven Piano & Organ Co.

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Electrician Publishing Co.

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**Push Buttons.**
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Klipstein & Co., A.

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Ostrander & Co., W. R.
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Central Electric Co.
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New York Insulated Wire Co
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Simplex Electrical Co.
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Electric Appliance Co.
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Forsyth & Fisk.
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McEvoy, C. H.
Mianus Electric Co.
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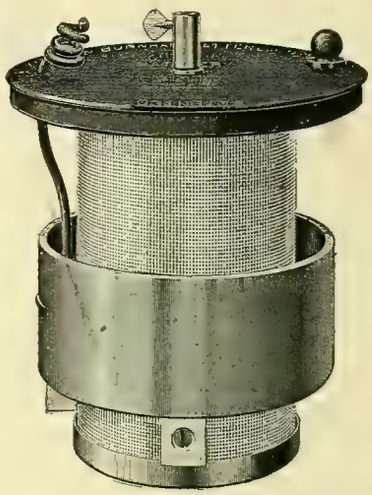
# GORDON PRIMARY BATTERY

## EXCELS IN:

1. **LONG LIFE.**—Warranted to operate, at a discharge rate of eight or ten one-hundredths of an ampere, six months without any attention whatever, as required for Railway Signal Service, and much longer where less power is required.
2. **EFFICIENCY.**—It will perform many kinds of work that cannot be obtained from the Gravity Battery.
3. **ECONOMY.**—The installations and maintenance of the Gordon Battery for one year for Railway Signal Service is about one-half the cost of the Gravity Battery.
4. **ADAPTABILITY.**—The Gordon Battery will work equally well on either open or closed circuit.
5. **IT IS ABSOLUTELY NON-FREEZING.**—In practical operation in Railway Signal Service, the Gordon Battery on the surface of the ground has worked uninterruptedly, with the mercury four degrees below zero. Gravity Batteries at the same station, eight feet under ground, at the same time, froze solid.
6. **LABOR SAVING.**—It requires no supervision whatever during its life.
7. **FREE FROM LOCAL ACTION.**—It is not consumed by local action when not in service. Gravity Batteries require constant attention and "feeding," whether in use or not, while the Gordon Battery is not a self-consumer, all its elements remaining intact until required to produce power.
8. **FREEDOM FROM GASES AND ODORS.**—It is clean and neat in appearance, and absolutely free from noxious fumes and gases, and "creeping" salts.
9. **SUPERIOR GENERATION OF ENERGY.**—Its product in useful energy is four times greater, weight for weight, than the Gravity Battery.



These Batteries are in use by the most prominent Telephone, Fire Alarm and Railroad Companies of America.

Send for descriptive circular and price list.

We guarantee all our Cells.

**Manufactured by**

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## Giant Strain Insulators.

Insulated with **Moulded Mica.** Hangers, Pull-Overs, Feed-Wire Insulators, Frogs, Section Insulators, etc.

**VULCABESTON CONTROLLER REPAIR PARTS.**

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NEW YORK. PHILADELPHIA. BOSTON.

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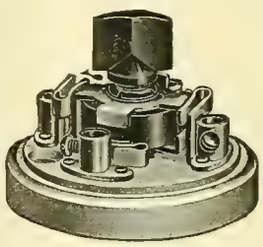
**STANDARD SWITCHES, 5 and 10 ampere S. P.**
**10 amp. 3 and 4-way, 10, 15, 30 and 50 amp. D. P.**



## FLUSH SWITCHES

Of any of the above sizes, either on single plates or with any number of switches upon one plate.

***Cut illustrates 4-way or commutation switch, controls a light or group of lights from any desired number of points.***

**SEND FOR CATALOGUE.**

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**Hartford, Conn.**

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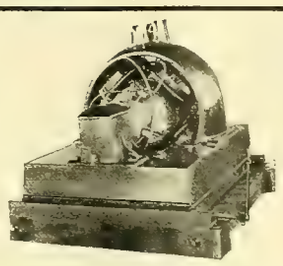
## CARD

Generators for Power Transmission or Isolated Lighting.

CARD Generators are all Multipolar and Slow Speed.

**AGENTS WANTED IN UNOCCUPIED TERRITORY.**



75 K. W. GENERATOR.

## CARD

Multipolar Slow Speed Stationary Motors.

Reversible Motors and Controllers for Rolling Mills, Bridges and Traveling Cranes.

**THE CARD ELECTRIC COMPANY,**

**Office and Works, Mansfield, Ohio.**

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**THE PIONEER FIRM.**
American Branch Office, 60 Liberty St., New York.

## F. HARDTMUTH & CO., VIENNA, AUSTRIA,

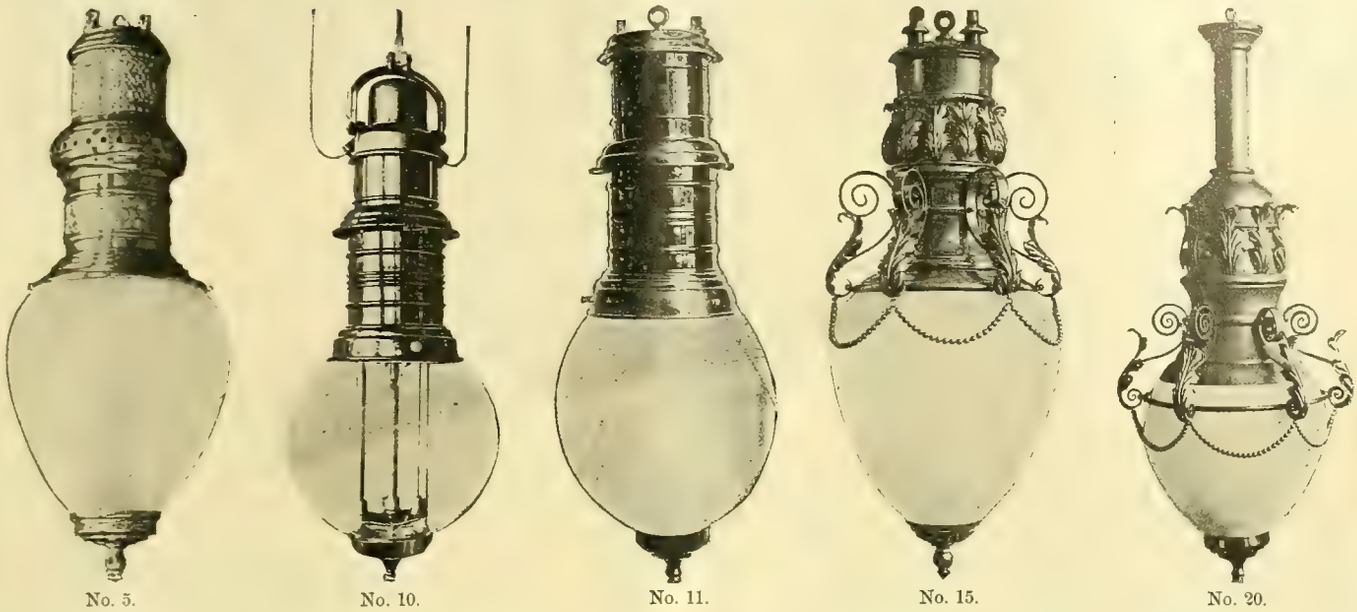
**THE ONLY MANUFACTURERS OF**

**THE PIONEER FIRM.**
Beware of Impostors Claiming our Make.

# "The Celebrated Austrian Cored Carbons."

Send for Reduced Price Lists or Samples.
Alternating or Direct Cored Carbons One Price.

Special Quotations for Export Trade.
Leading Supply Houses Carry our Goods.



No. 5. No. 10. No. 11. No. 15. No. 20.

**Beauties,** every one of them, and no less practical and reliable than pretty. Recent changes in detail construction have greatly improved the **Helios Incandescent Arc Lamps,** and they can be depended upon for a steady, even white light, free from objectionable noise in the arc. A complete stock of plain, standard types, also a variety of ornamental designs. Ask for our new catalogue of Lamps.

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BUFFALO: 112 White Building.

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Western Agents: Okonite Wire, Interior Conduit, Lundell Motors.

# THE ONLY REFLECTOR PLATE ALTERNATING ARC LAMP.

## The Helios Electric Company claims:

That they have more alternating arc lamps in use than all other makes combined.
They guarantee 80 per cent. more available light than is obtained from any other alternating arc lamp.
They guarantee to give as much light as any direct current lamp using the same number of watts.

# SPENCER'S IMPROVED ALTERNATING ARC LAMP

## Possesses the following advantages:

Minimum choke in the regulating coil.
Practically no energy absorbed in the regulating device.
Durability of all its parts; not liable to get out of order.
Can be used successfully on all periods.
Starts quickly.

# SPENCER'S DIRECT CURRENT CONSTANT POTENTIAL LAMP.

## Guaranteed not to see-saw.

**SEND FOR CATALOGUE AND PRICES.**

# HELIOS ELECTRIC COMPANY,

1229 Callowhill Street, PHILADELPHIA, PA.

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# STORAGE BATTERIES.

**THIS LINE**

Represents the present annual operating expense of the plant of the

**Chicago Board of Trade.**

And **THIS ONE**

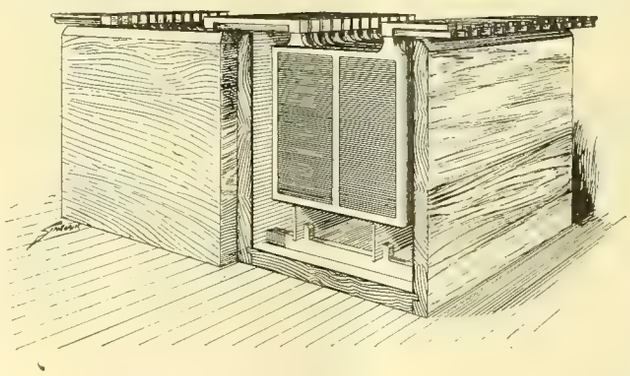
Represents the expense as it will be when the

**RECONSTRUCTED PLANT**

is in operation.

## And THIS is the BATTERY that HAS BEEN SELECTED to help accomplish this result.

Plate made from one integral piece of rolled virgin lead without joints, solder or applied active material.



PUMPELLY-SORLEY CENTRAL STATION CELL.

If you have a line of expense you want **cut down,** or a **load line evened up,** don't be misled by the exaggerated claims of others regarding **"Underlying principles,"** but write us.

**WE WILL PROTECT AGAINST SUITS FOR INFRINGEMENTS.**

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# PUMPELLY-SORLEY STORAGE BATTERY CO.,

**Main Office: 1540 Marquette Building, Chicago.**

# THE BOUDREAUX DYNAMO BRUSH
## IS NO EXPERIMENT.

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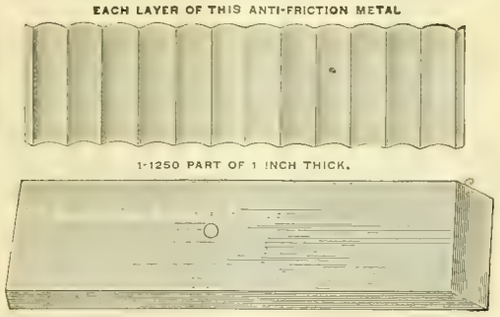
American Electric Works, Denver.
Baldwin Locomotive Works, Philadelphia.
Christy Fire Clay Co., St. Louis.
Columbus Memorial Building, Chicago.
*Detroit Journal*, Detroit.
Edison Electric Illuminating Co., New York.
Feigenspan's Breweries, Newark, N. J.
Griffin Wheel Co., Chicago.
Holtzer-Cabot Electric Co., Boston.
Interior Conduit & Insulation Co., New York.
W. W. Kimball Co., Chicago.
Marlborough Hotel, New York.
Pullman Car Co., Pullman, Ill.
Western Union Telegraph Co., New York.




SOME OF ITS USERS:

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Buckeye Electric Co., Cleveland.
Central District Printing Telegraph Co., Pittsburg.
Crocker-Wheeler Electric Co., Ampere, N. J.
Drexel Institute of Art, Science and Industry, Phila.
Elwell-Parker Electric Co. of America.
Franklin Sugar Refining Co., Philadelphia.
General Machinery Co., Portland, Ore.
Hirsh, City Engineer, Cincinnati.
Indiana Paper Co., South Bend, Ind.
Keystone Electric Co., Erie, Pa.
Metropolitan Museum of Art, New York.
Palmer House, Chicago.
Wagner Palace Car Co., New York.

## THE BOUDREAUX DYNAMO BRUSH COMPANY,

**Mallers Building, CHICAGO. Postal Telegraph Building, NEW YORK.**

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For Texas, Indian Territory, New Mexico and Arkansas, BARDEN-SHEETS ELECTRICAL CONSTRUCTION CO., Houston, Texas.

# CENTRAL STATION SUPPLY CONTRACTING STREET RAILWAY MEN!!

DEAR SIRS:—As the Fall and Winter seasons are now approaching, permit me to call your attention to an exceptional opportunity for the purchase of ARC LAMPS and CARBONS. The goods which I am offering **must be sold to close an estate** and I can offer them at figures which cannot be duplicated in the electrical trade.

These goods are of STANDARD MAKES, ENTIRELY NEW and in PERFECT ORDER, and the offer will not remain open long. They consist of STANDARD "WARD" ARC LAMPS FOR DIRECT AND ALTERNATING Current Circuits; also Series, Focusing, Double Carbon and Railway "WARD" Lamps. The "WARD" Lamp is the Arc Lamp which built up the business of Arc Lighting on Incandescent Circuits, and more of them have been sold than of all the other makes in this country.

I can offer also the "KNIGHT" ARC LAMP for both DIRECT and ALTERNATING Current Circuits, for series and railway work, and twin lamps. "Knight" Lamps are offered by several other parties, but it is not possible for them to give the low prices I quote.

I have also a large stock of FOREIGN and DOMESTIC CARBONS of the following types:

## Foreign--SIEMENS, LACOMBE, HARDTMUTH AND SHIP CORED.
## Domestic--NATIONAL, FIDELITY, SOLAR AND GLOBE.

Write me at once, stating kind, size and quantity you desire. Yours truly,

**CHAS. H. WATERMAN,** 1305 HAVEMEYER BUILDING, 26 Cortlandt St., NEW YORK.

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**IF** you are anxious to secure the latest electrical books, **YOU** should write to the Electrician Publishing Co., Chicago. You **CAN'T** procure too many reliable, readable books to **READ.**

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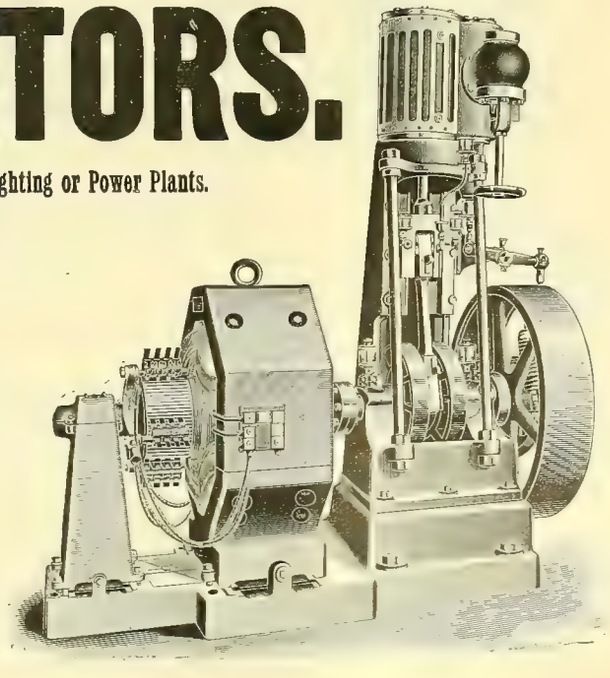
**Direct Connected or Belted for Electric Railways, Central Stations, Isolated Lighting or Power Plants.**

## EDDY MOTORS—SLOW, MEDIUM OR HIGH SPEED.

***We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.***



## THE EDDY ELECTRIC MFG. CO.,
## *WINDSOR, CONN.*

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WE MANUFACTURE THE "GLOBE." LIFE AND EFFICIENCY GUARANTEED.

New Process of Exhaustion by Mechanical Vacuum Pump. Absolutely Dry Vacuum. Samples and Prices Furnished on Application. Correspondence Solicited.

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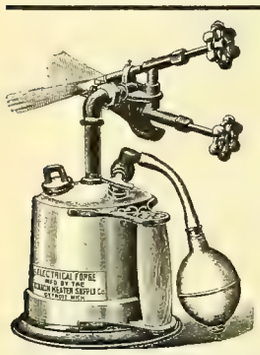
*(Stationary, Locomotive or Marine); Mechanics; Mechanical Drawing; Electricity; Architecture; Architectural Drawing and Designing; Masonry; Carpentry and Joinery; Ornamental and Structural Iron Work; Railroad Engineering; Bridge Engineering; Municipal Engineering; Plumbing and Heating; Coal and Metal Mining; Prospecting, and the English Branches.* Students make rapid progress in learning to Draw and Letter. The Steam Engineering course is intended to qualify engineers to secure Licenses. Send for free Circular, stating the subject you wish to study, to

**The International Correspondence Schools, Scranton, Pa.**

TAUGHT BY MAIL THOROUGH PRACTICAL



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ELECTRICIANS, CYCLE MAKERS AND ENGINEERS.

Nothing better for wire soldering. Where once used it is indispensable.

The Flames are Strong Enough to Melt Copper.

UNION HEATER SUPPLY CO.,

92 Congress St., East DETROIT, MICH.

## THE UPTON ARC LAMP

**For All Circuits.**

**The Cheapest to Buy, Use and Maintain.**

## Standard Thermometer Co.,

PEABODY, MASS.

The Original Manufacturers of the

*SIMPLEX, WARD and KNIGHT LAMPS.*

CHARLES A. BRAMHALL, Selling Agent, 39 Cortlandt Street, NEW YORK.

# THE DAYS ARE GROWING DARK,

# YOU NEED MORE LIGHT.

## ARC LAMPS

DIRECT CURRENT,
ALTERNATING,
ORNAMENTAL.

## GENERAL INCANDESCENT ARC LIGHT CO.'S LAMPS

*CAN MEET YOUR DESIRE FOR STYLE AND PRICE.*

## "SUN-SCHMELZER-NURNBERG" CARBONS.

If you want anything in the Arc Lamp or Imported Carbon Line, write to me.

# R. B. COREY, GENERAL SALES AGENT,

HAVEMEYER BUILDING, NEW YORK.

# THE ELECTRIC STORAGE BATTERY COMPANY

## OF PHILADELPHIA, PA.,

In addition to all American Patents heretofore controlled, has recently acquired from the

## Accumulatorem-Fabrik Aktien-Gesellschaft,

OF HAGEN (IN WESTPHALIA), PRUSSIA.

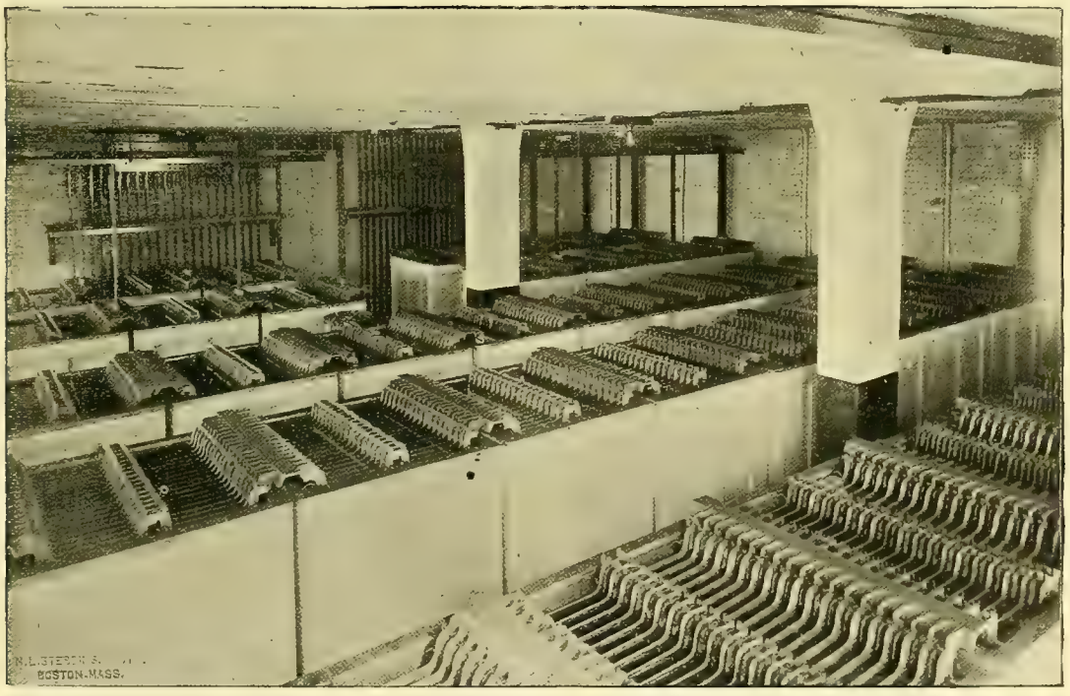
All patent rights for the exclusive manufacture of

## Tudor Storage Batteries

in the United States, and is prepared to furnish Batteries of this type of any desired size.

**In Germany and Austria** the TUDOR BATTERY is used in eighty per cent. (80%) of all Central Stations—besides being installed in

## 15 RAILWAY POWER PLANTS and 5000 ISOLATED LIGHTING PLANTS.



TUDOR STORAGE BATTERIES—BOSTON EDISON STATION.

**Storage Batteries are Needed in Central Stations:**

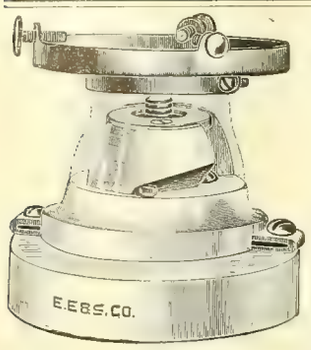
**1st.** To effect reduction in first cost of plant. (Half steam power plant and half Storage Battery Plant costs only three-quarters of what all Steam Plant would cost for same work.)
**2d.** To convert variable into steady loads. This will save machinery from strain.
**3d.** To effect a saving of from 20 per cent. to 40 per cent. in coal bills.
**4th.** To insure reserve power in case of accident to generating machinery.

For particulars address,

# The Electric Storage Battery Company,

Sole Manufacturers of the "CHLORIDE ACCUMULATOR,"

**PHILADELPHIA, PENNSYLVANIA.**




# E. E. & S.

## RECEPTACLE FOR SHADE HOLDER.

Double pole. Easily fused. No wiring to the socket. Contact made direct on the rosette ears. Top porcelain is interchangeable, and will fit any one of our different styles of rosette bases.

# Electric Engineering and Supply Company,

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# ELECTRICAL BOOKS Of All Kinds.

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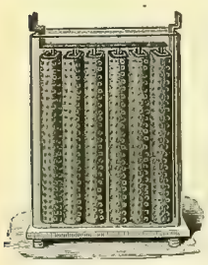
# The Ohio Storage Battery Company,



**Sole Manufacturers, under Exclusive License, of the Ford-Washburn Storelectro Co.'s Storage Batteries:** **The most durable Batteries ever produced. For Street Railways, Lighting Plants, Electric Launches, Electric Carriages, Doctors and Dentists; and for any other work where Storage Batteries can be used.**

**SPECIALTIES:** Isolated Plants for house lighting, and cells for surgical, telegraph, telephone and phonographic uses. Small cells made to order. Send for catalogue giving capacities, weights, etc.

**MAIN FEATURES OF THE CELL:** **The ability to stand an incessant charge and discharge without any injury, which is an advantage that cannot be exaggerated; the capability of enduring a repeated discharge on a dead short circuit without injury to the cells; the special form of cell which frees it from the weaknesses that have made other types a failure.**

**EASTERN OFFICE: 203 Broadway, New York City. J. A. MACHADO, Agent.**

THE OHIO STORAGE BATTERY CO., 52 WADE BUILDING, CLEVELAND, OHIO, U. S. A.

# NOTICE!

The Siemens & Halske Electric Company of America, as the owner of United States patents of Siemens & Halske, Berlin, makes the following announcement:

The firm of Siemens & Halske, Berlin, was established by the late Dr. Ernst Werner von Siemens in 1848, and has ever since been the pioneer in all branches of electrical work.

In 1867 Dr. Siemens built the first dynamo electric machine, and gave it the name, "dynamo electric machine," by which it is now universally known. The well-known Siemens armature for dynamo electric machines was the invention of Dr. Siemens.

In 1879 Dr. Siemens exhibited the first electric railway embodying all the modern principles of electric locomotion.

In 1878 von Hefner-Alteneck, one of the engineers of Siemens & Halske, invented the first differential arc lamp, which enabled a series of arc lamps to be used in the same circuit.

Numerous patents upon the inventions of Dr. Siemens and his assistants have been obtained in the United States, and makers, sellers and users of electrical apparatus are notified and warned to avoid infringements, as the rights secured under these patents will be protected.

Attention is particularly drawn to a few of the patents covering some of the principal articles of electrical manufacture:

| DYNAMOS AND MOTORS. | |
|---|---|
| 389,752 | September 18, 1888. |
| 395,019 | December 25, 1888. |
| 496,567 | May 2, 1893. |
| 509,662 | November 28, 1893. |
| 513,507 | January 30, 1894 |
| 520,264 | May 22, 1894. |
| 528,608 | November 6, 1894. |
| 530,114 | December 4, 1894 |

| ARC LAMPS. | |
|---|---|
| 412,141 | October 1, 1889. |
| 498,566 | May 30, 1893. |
| 506,503 | October 10, 1893. |
| 518,719 | April 24, 1894. |

| ELECTRIC MOTOR CAR. | |
|---|---|
| 322,859 | July 21, 1885. |
| 324,176 | August 11, 1885. |
| 480,310 | August 9, 1892. |
| 486,920 | November 29, 1892. |
| 490,307 | January 24, 1893. |
| 493,942 | March 21, 1893. |
| 493,943 | March 21, 1893. |

| TROLLEY STAND and TROLLEY. | |
|---|---|
| 487,813 | December 13, 1892. |
| 506,463 | October 10, 1893. |
| 520,274 | May 22, 1894. |
| 530,416 | December 4, 1894. |
| 536,967 | April 2, 1895. |

| CONDUIT RAILWAY. | |
|---|---|
| 478,026 | June 28, 1892. |
| 486,315 | November 15, 1892. |
| 503,710 | August 22, 1893. |
| 509,421 | November 28, 1893. |
| 520,356 | May 22, 1894. |
| 530,286 | December 4, 1894. |

| 3 and 5 WIRE SYSTEMS. | |
|---|---|
| 497,755 | May 16, 1893. |
| 501,095 | July 11, 1893. |
| 542,979 | July 16, 1895. |

No. 417,668, December 17, 1889, is a patent on what is usually termed to-day, "THE DIRECT-CURRENT BOOSTER." This is a fundamental patent, and covers every known construction of boosters. Its use is extending every day in lighting and railway stations throughout the country.

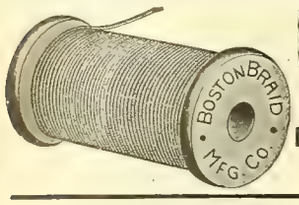
A number of corporations and users of our apparatus and methods have taken licenses, and are now paying us royalties under our patents.

We are prepared to furnish apparatus, licensed under the patents mentioned above, and under numerous other patents already issued, and others soon to be issued, and shall be pleased to communicate with prospective customers concerning licenses under any of our patents.

# SIEMENS & HALSKE ELECTRIC COMPANY OF AMERICA,

1215 MONADNOCK BLOCK, CHICAGO.

PARANITE
WIRES
UPTON
ARC
LAMP.
ELECTRIC APPLIANCE. COMPANY.
242 MADISON ST.
CHICAGO.
ILL.
PARANITE
TRADE MARK
H.J. SINCLAIR
ELECTRICAL SUPPLIES

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For Arc Light and Trolley Cord.

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This system does not infringe the patents of the Bell Telephone or Western Electric Co. We build exchanges complete for local companies, or will install and operate exchanges ourselves at a low monthly rental. We keep in stock Blake transmitters and all kinds of supplies.

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For Exchanges, Etc.

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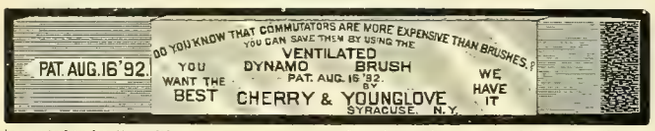


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*The Valentine-Clark Co.,*
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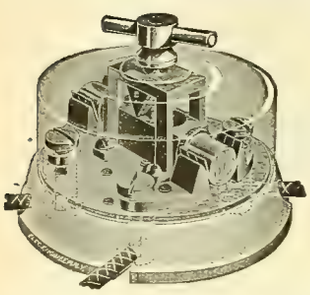

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TRY THEM AND WONDER WHY YOU EVER USED ANY OTHER.

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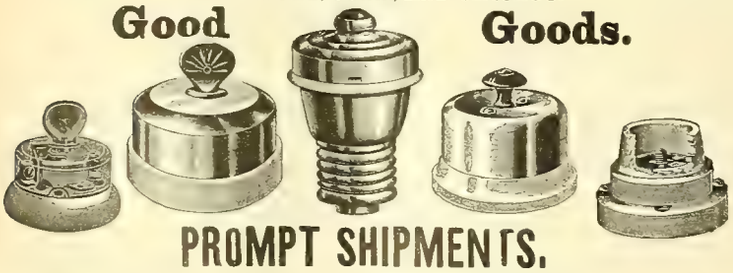

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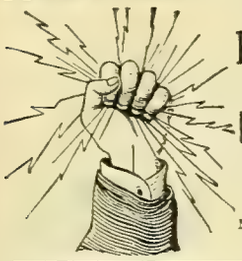

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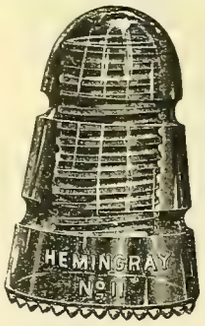
CHICAGO STORE, F. E. Donohoe, 241 Madison St.
MONTREAL BRANCH Eugene F. Phillips' Electrical Works.

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**Can be Used for Transposing.**

The points or teats on the lower rim of the petticoat attracts the water on the outer surface of the insulator into drops. The water drops from these points on to the cross-arm, thereby preventing the moisture from creeping up on the inner petticoat, and thence to the pin. Owing to the great success of our Patent Teat Insulator in Telegraph Work, where the efficiency of the Insulator has proven to be more than twice that of the ordinary Insulator, we have concluded to apply the device to all Insulators for Telegraph, Telephone and Street Railway Work.

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GENTLEMEN:—We have one of your Governors in use at our power house at Millers Falls, Mass., taking care of two water-wheels to perfection, regulating the power *within a few volts.* We took out one Governor and replaced it with a LOMBARD GOVERNOR which gives *perfect satisfaction.* Yours truly, MONTAGUE ST. RY. CO.,
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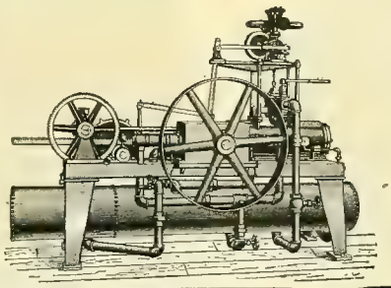

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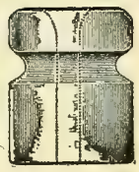

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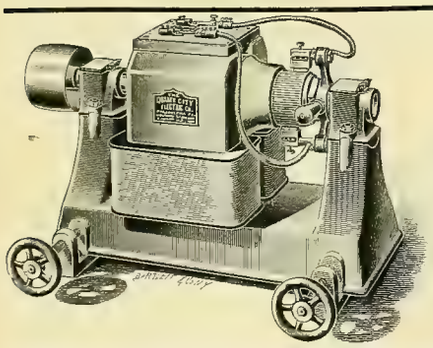

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All-round Electrician and Engineer, one capable of running good-sized plant in So. Minnesota: must be first-class lineman, wireman, and capable of repairing T.-H lamps and transformers. Address, stating experience, references and salary, "**O. E. C.,**" WESTERN ELECTRICIAN, Chicago.

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Separate bids are invited: (a) for engines and piping; (b) electrical apparatus; (c) line construction. Each bid shall be accompanied by a certified check for three per cent. of the bid.

Plans and specifications may be seen at the office of the City Engineer, Mankato, and of Geo. D. Shepardson, University of Minnesota, Minneapolis.

By order of Common Council, City of Mankato, Minn.

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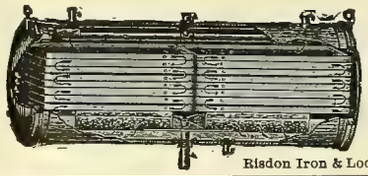

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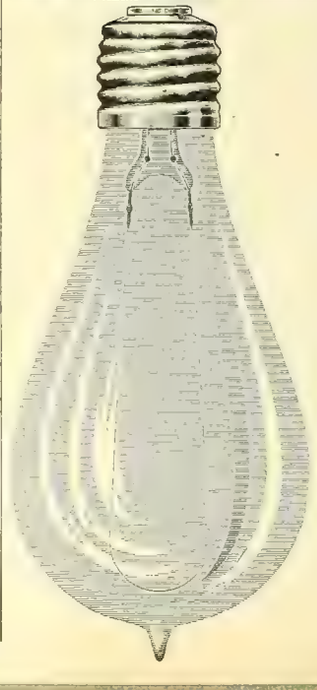

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Unrivalled for long life, economy in current consumption and freedom from blackening.

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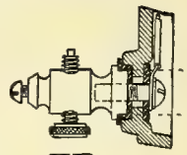

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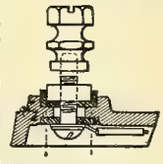

**Style F, Pivoted Armature Iron Frame Bell.**

**Styles L R M, Iron Box Bells.**

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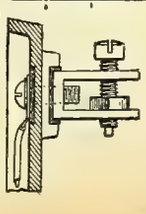

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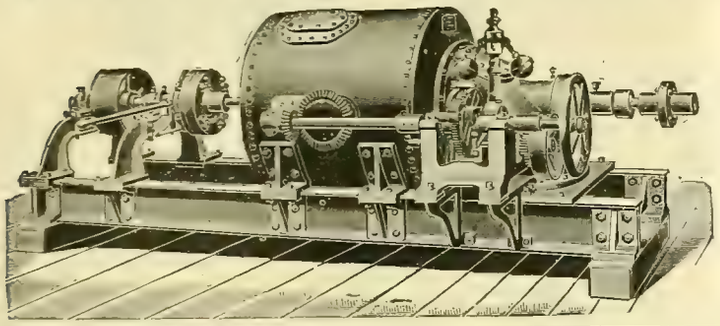

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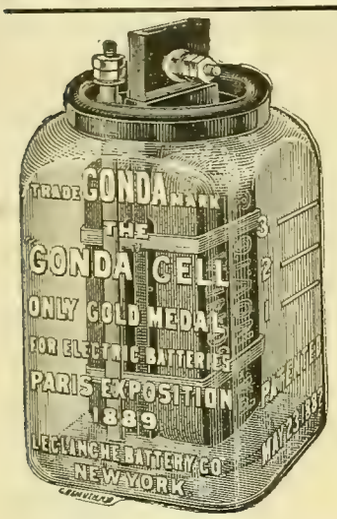


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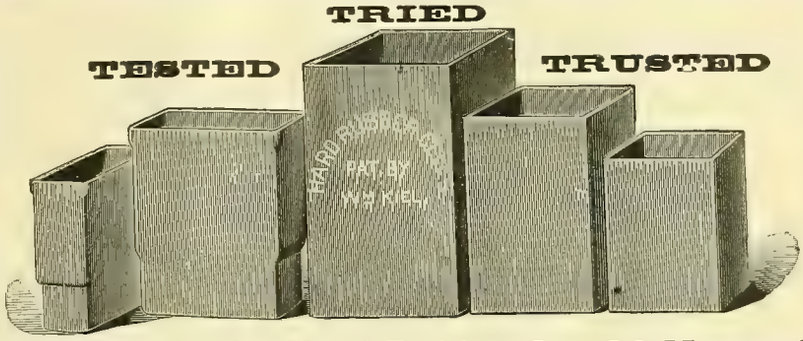


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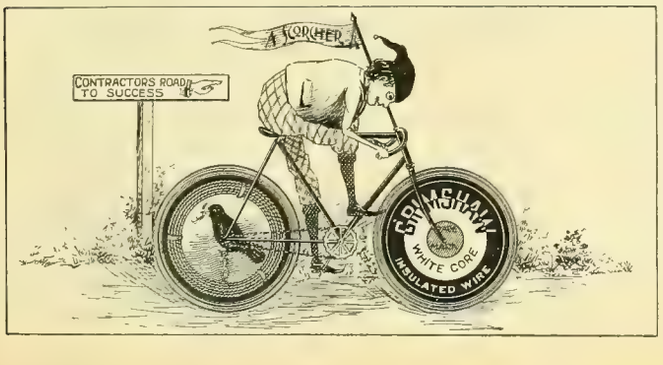


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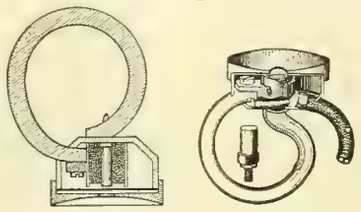
ductor. In the D'Arsonval receiver a curved permanent magnet is used, one pole of which terminates



FIGS. 27 AND 28. D'ARSONVAL RECEIVER.

in a soft iron polepiece that serves as the core of the coil, and the other in an iron box, or cylinder, that

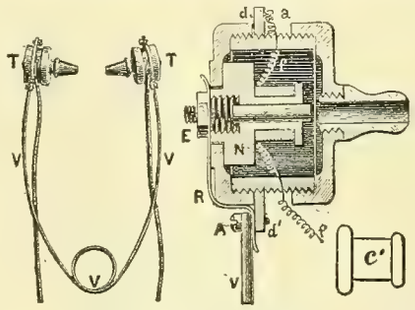



FIG. 29. MERCADIER'S BI-TELEPHONE. *T T* RECEIVERS, *V* SPRING, *N* MAGNET, *E* NUT, *R* STEEL STRIP. *A* SCREW CLAMPING *R* TO *V*, *d d'* METAL COLLAR CLAMPING *V* TO RECEIVER CASE, *f f* TERMINALS OF COIL *a* CONNECTING SCREW, *c'* SOFT RUBBER NIPPLE FOR EARPIECE.

completely encloses the coil. The two poles are magnetically insulated from each other by the wooden case, to the upper part of which the diaphragm is

48 TELEPHONE HAND BOOK.

appeared on the scene with an application for a patent on a microphonic transmitter, and according to the rules of the Patent Office no patent could be issued to any of the three until it was determined whether the Drawbaugh claim was valid or not. This was finally decided against Drawbaugh, as it was proved that the Edison carbon transmitter had been in public use for more than two years before Drawbaugh made his application for a patent, and his application was thrown out. A patent was then issued to Berliner on the broad

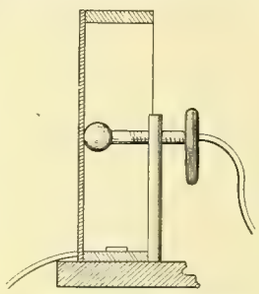


FIG. 44. BERLINER'S FIRST TRANSMITTER.

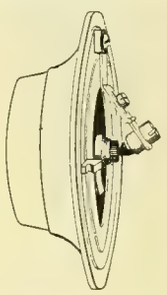


FIG. 45. BERLINER CARBON TRANSMITTER.

principle of the microphone transmitter in November, 1891. In May of the following year a patent was issued to Edison, so that both sides of the interference eventually got their patents—more than fourteen years after the filing of the original applications.

78. Both Berliner and Edison obtained in 1878 patents on special forms of transmitters designed in accordance with the principles laid down in their applications for the broad principle of battery telephones, and the Berliner transmitter especially has been modified out of all semblance to its original form. The broad claim in the Berliner patent is as follows: "The method of producing in a circuit electrical undulations similar in form to sound waves by caus-

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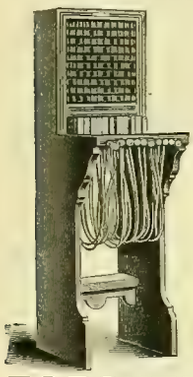

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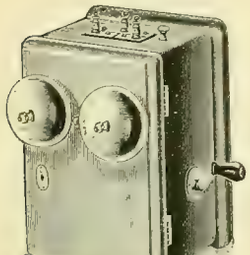

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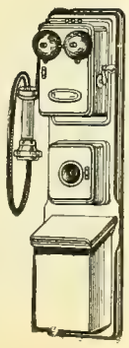

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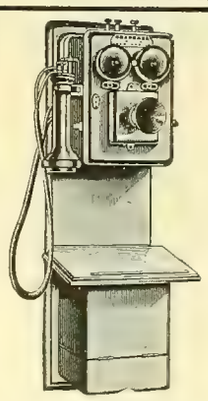

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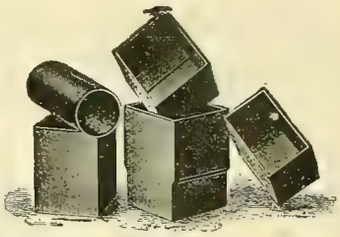

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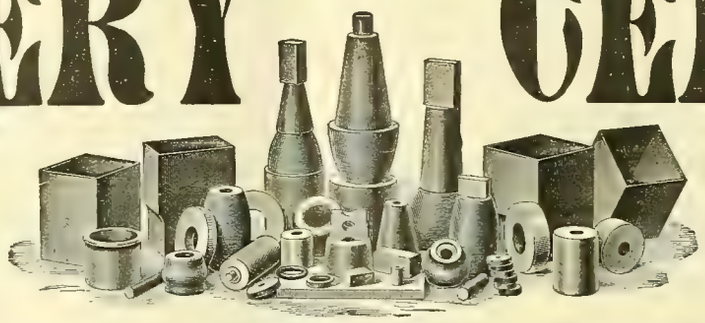

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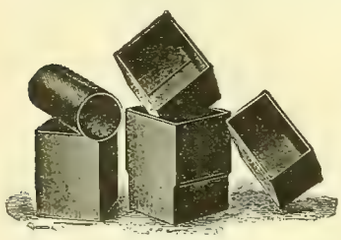

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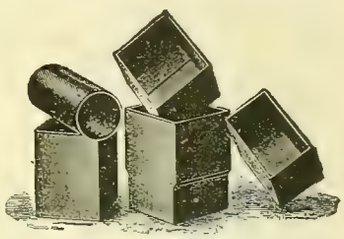

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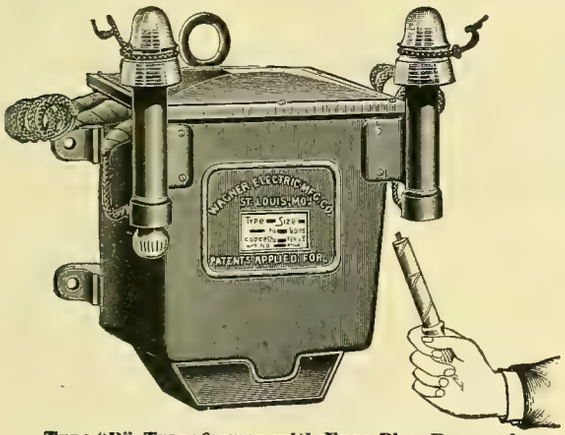

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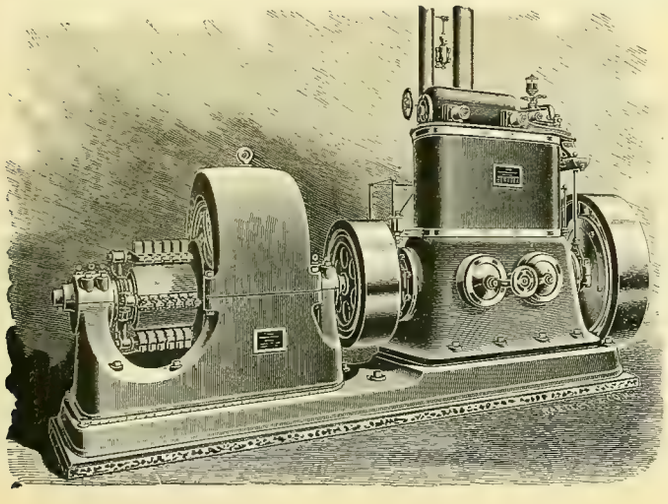

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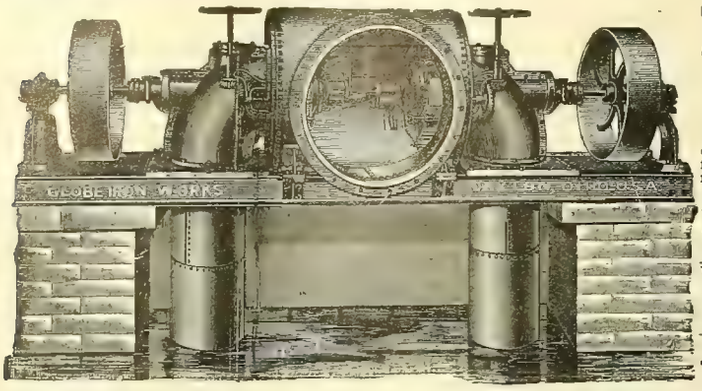


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| | Head. | Rev. per Min. | Cu. Ft. per Sec. | Horse Power. | P'r Cent |
|---|---|---|---|---|---|
| Whole Gate | 16.06 | 119.17 | 141.58 | 205.27 | 79 76 |
| ⅞ " | 16.42 | 122.00 | 127.18 | 195.19 | 82.58 |
| ¾ " | 16.78 | 117.33 | 112.60 | 175.74 | 82.18 |
| ⅝ " | 17.03 | 111.88 | 98.12 | 149.99 | 79.31 |
| ½ " | 16.88 | 118.67 | 82.07 | 118 40 | 75.52 |

**Test of a 42-inch Wheel -July 14, 1894.**

| | Head. | Rev. per Min. | Cu. Ft. per Sec. | Horse Power. | P'r Cent |
|---|---|---|---|---|---|
| Whole Gate | 16.33 | 128.00 | 134.18 | 199.56 | 80.60 |
| ⅞ " | 16.56 | 134.80 | 120.85 | 188.14 | 83.09 |
| ¾ " | 16.59 | 129.33 | 104.85 | 162.89 | 82.77 |
| ⅝ " | 17.13 | 125.25 | 92 76 | 142.40 | 79 21 |
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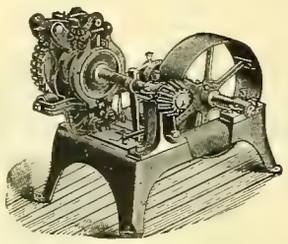

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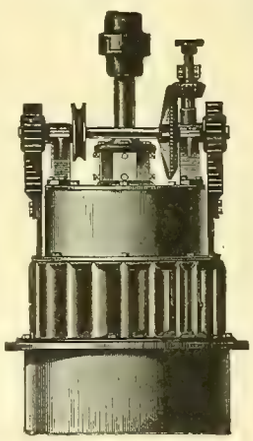

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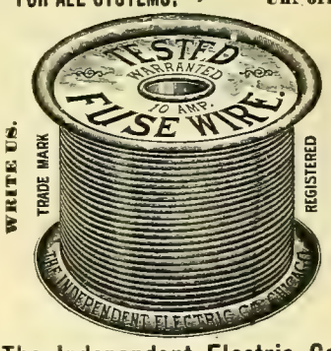


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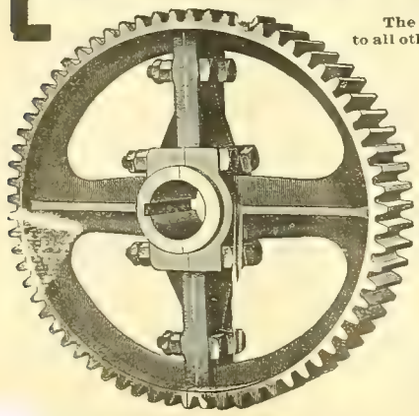

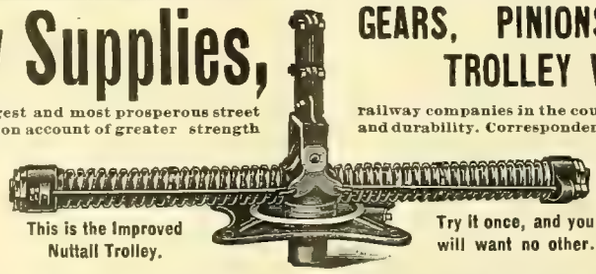

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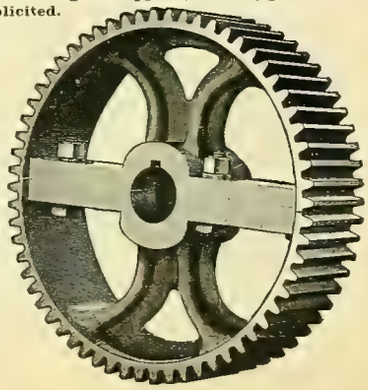

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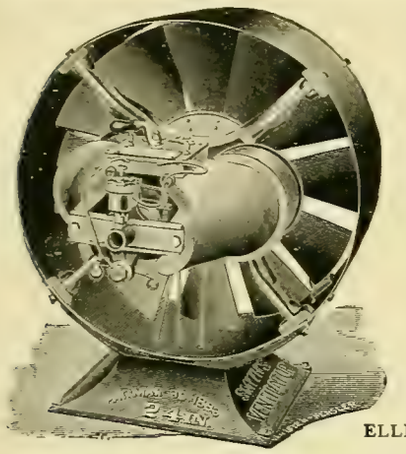

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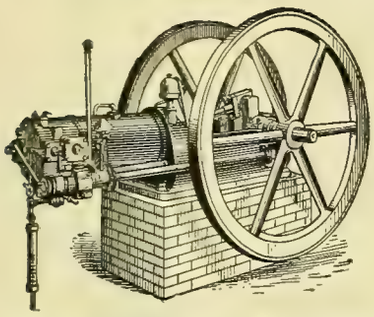

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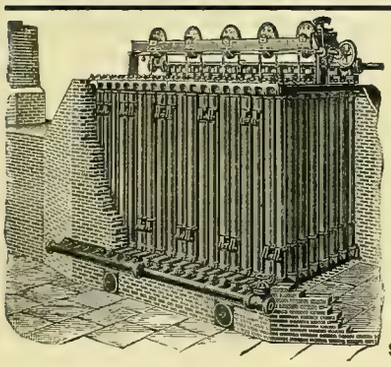

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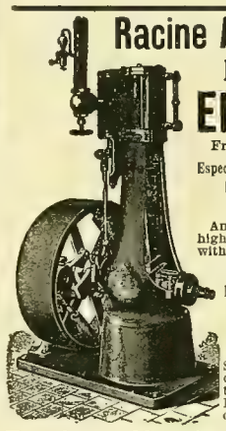

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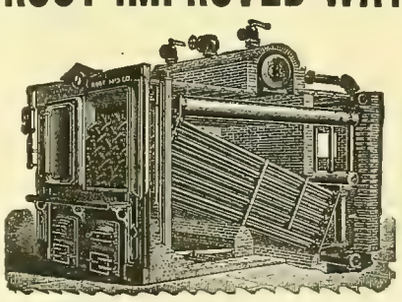

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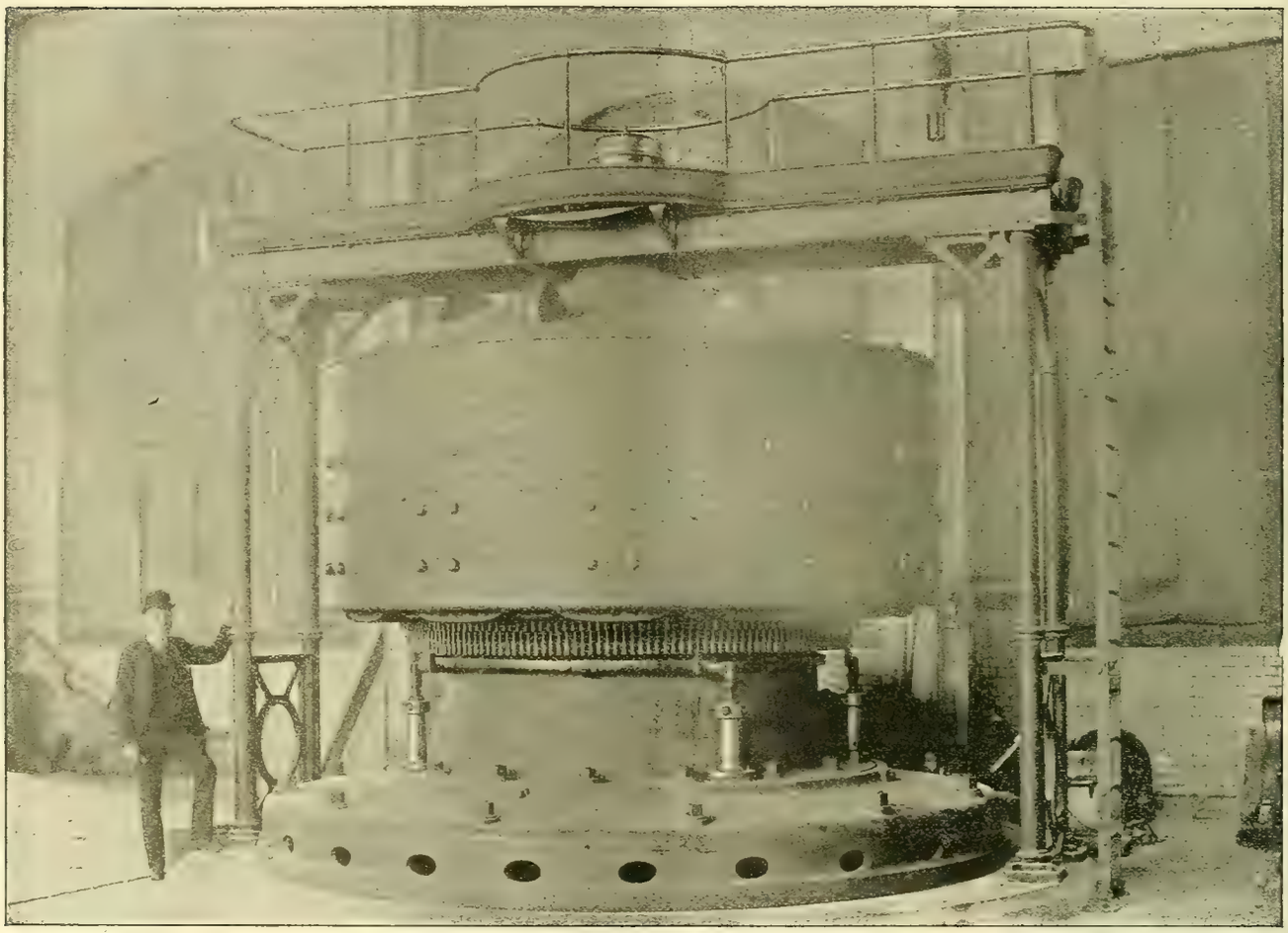

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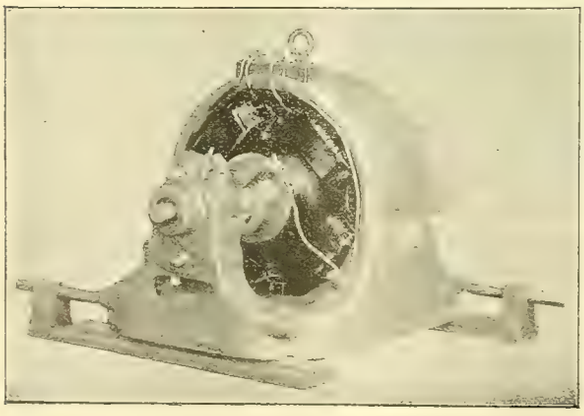

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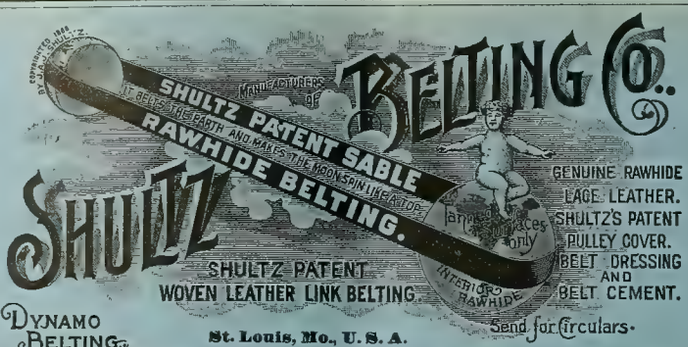


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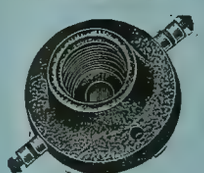

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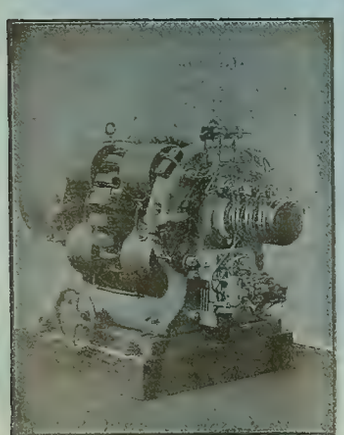

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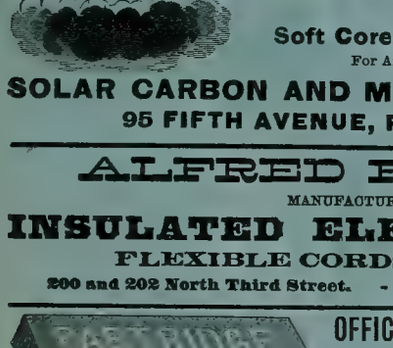


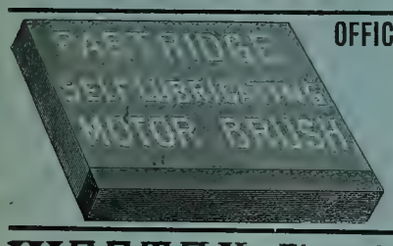


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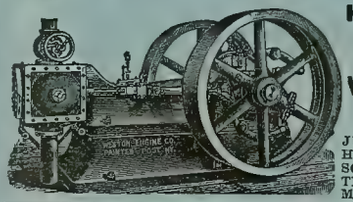

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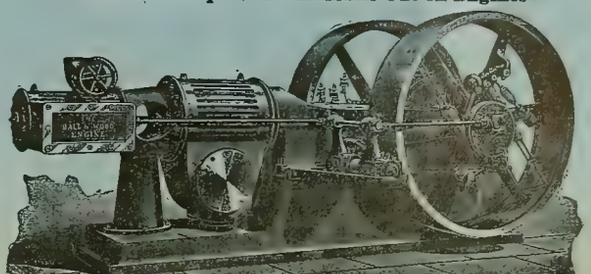

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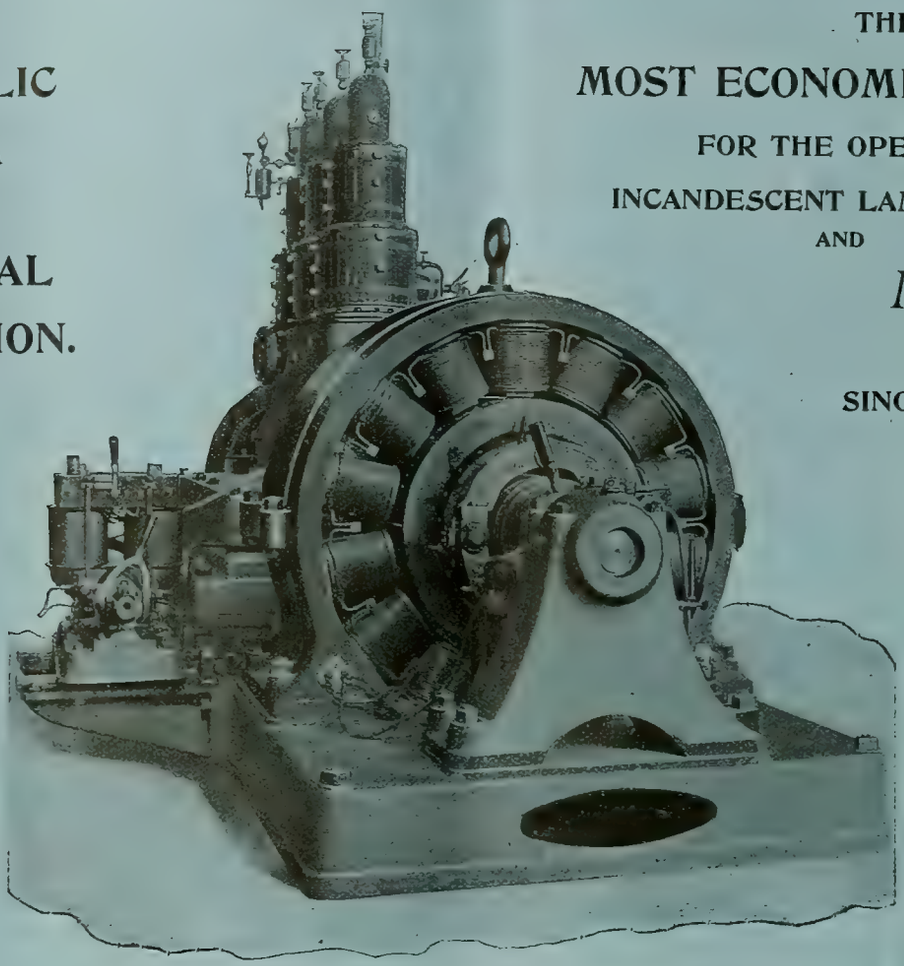

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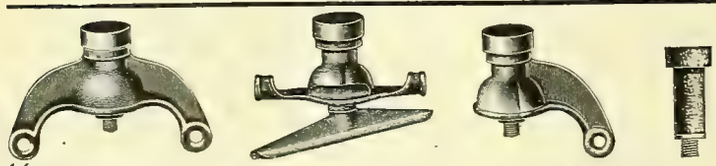

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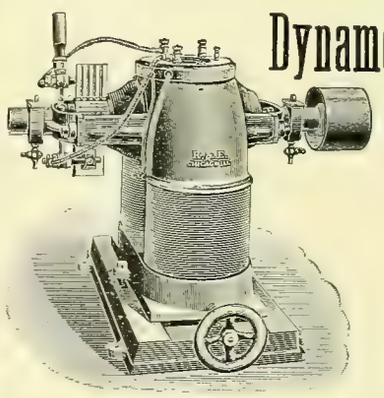

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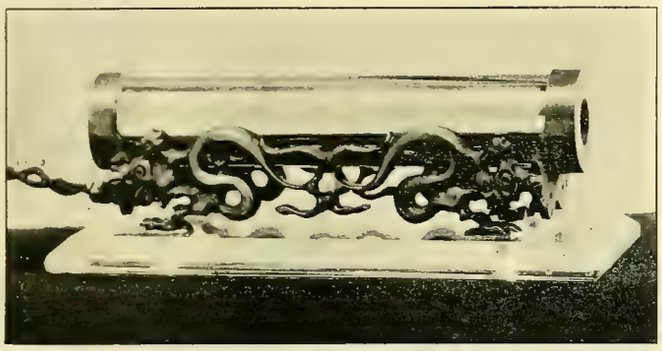

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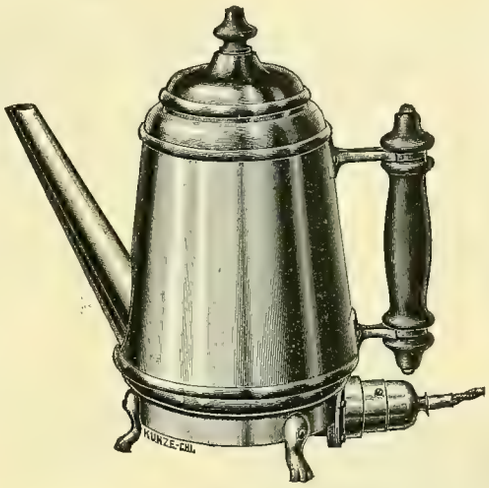

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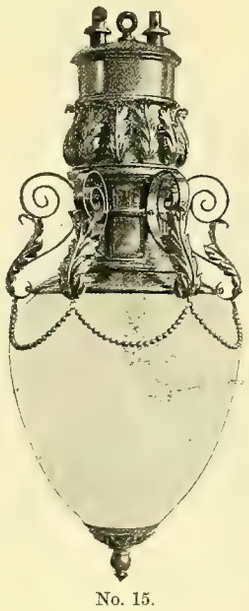

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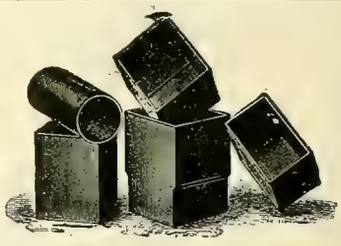

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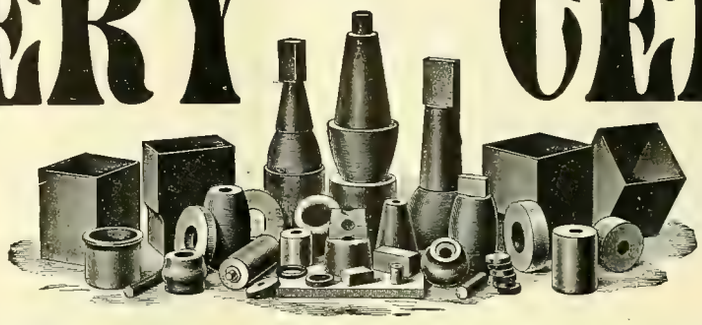

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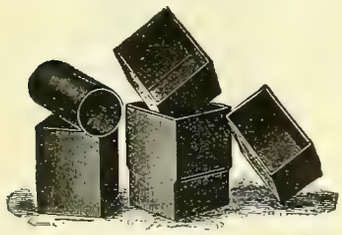

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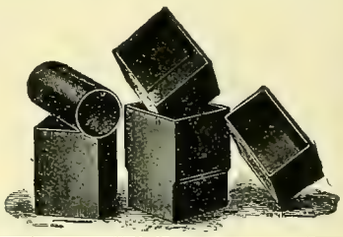

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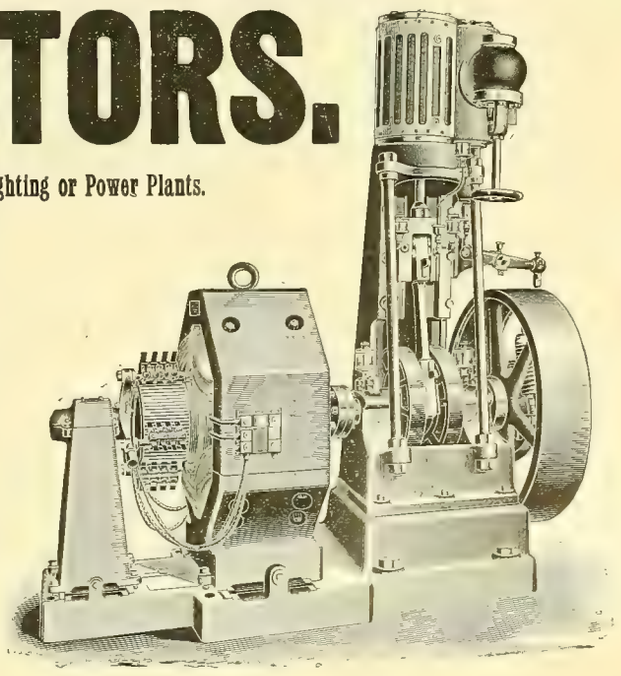

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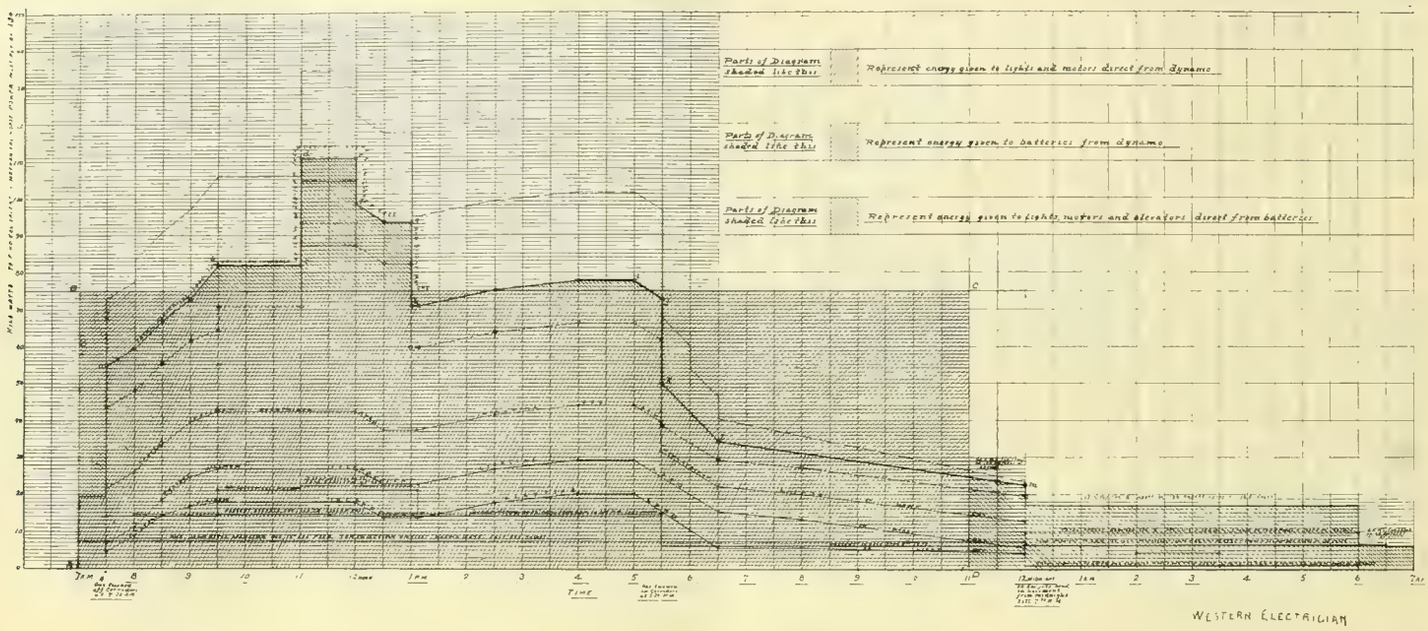


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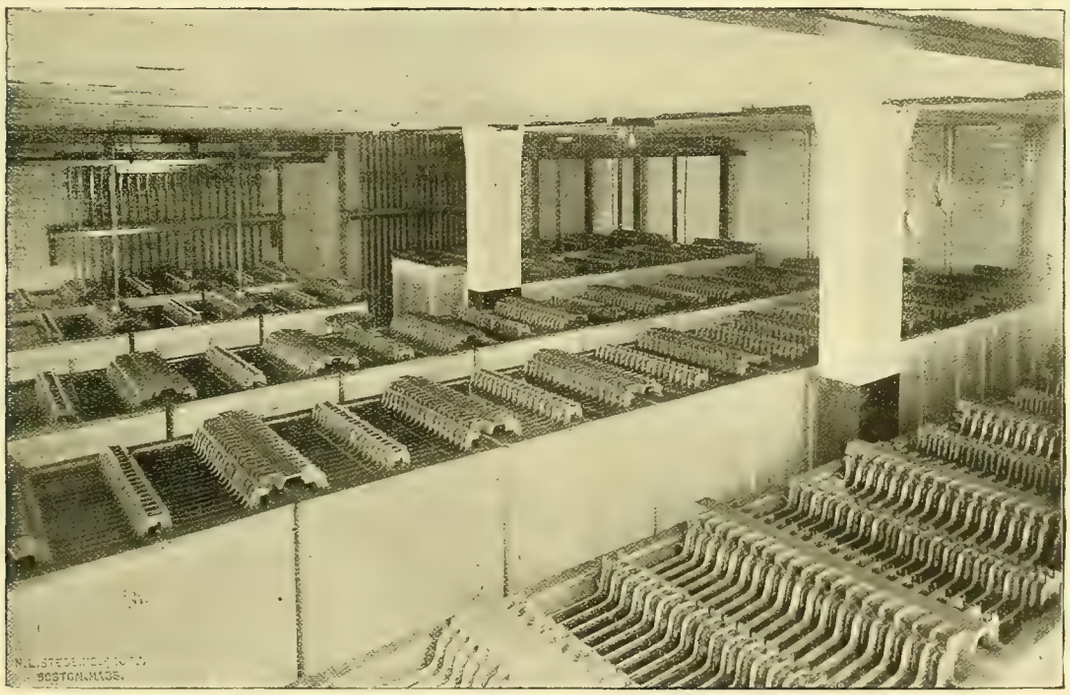

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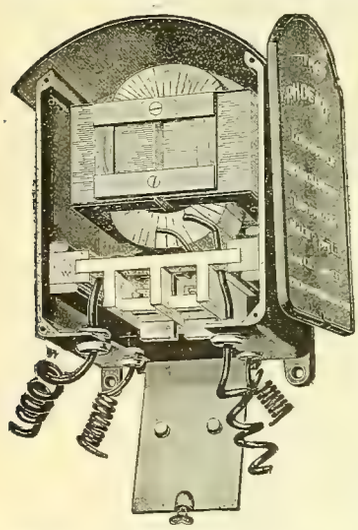

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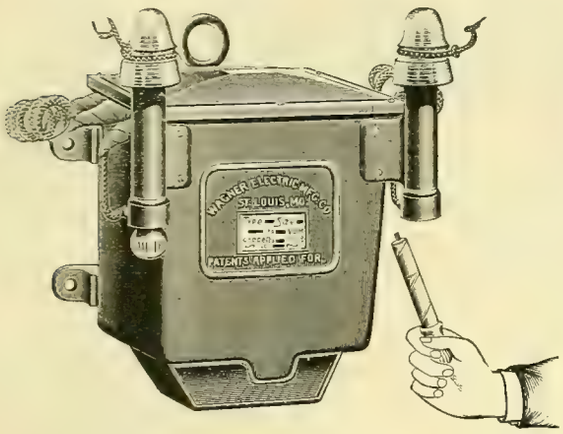


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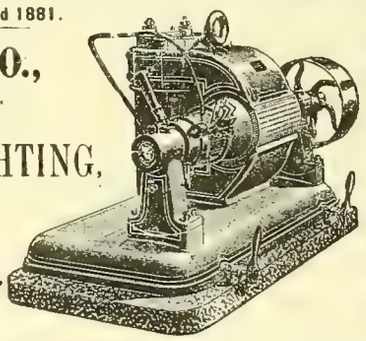

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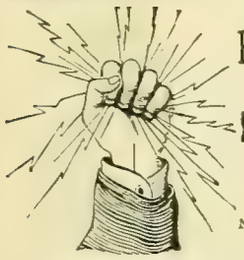

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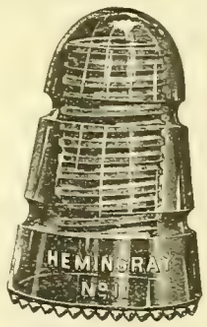


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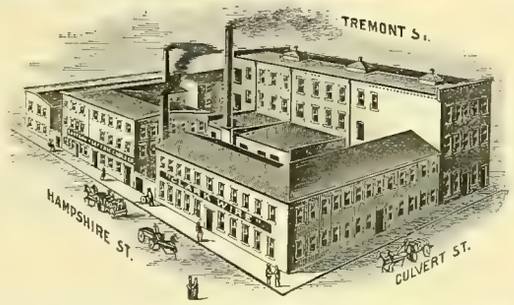


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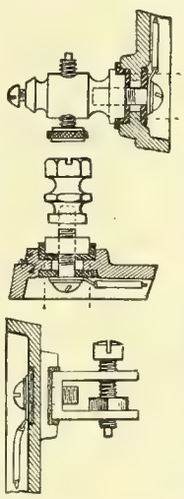

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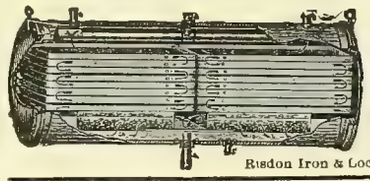

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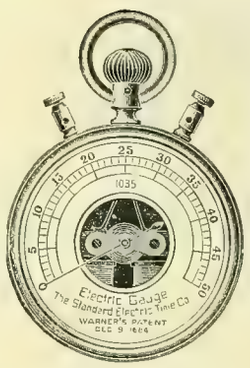


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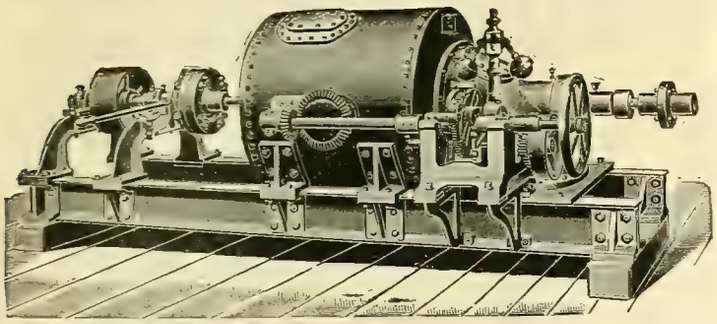

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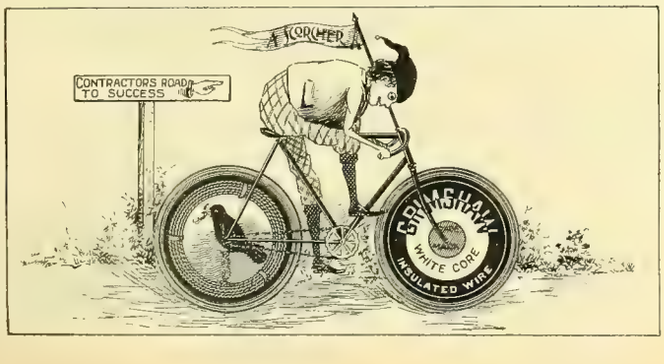


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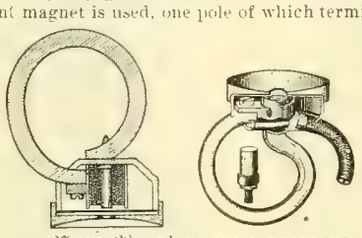
ductor In the D'Arsonval receiver a curved permanent magnet is used, one pole of which terminates



FIGS. 27 AND 28. D'ARSONVAL RECEIVER.

in a soft iron polepiece that serves as the core of the coil, and the other in an iron box, or cylinder, that

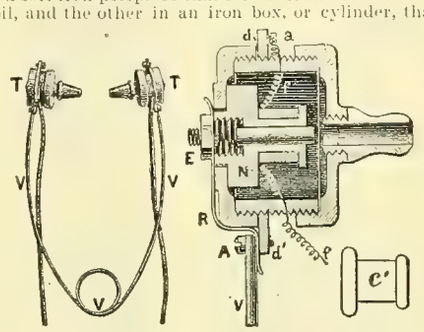



FIG. 29. MERCADIER'S BI-TELEPHONE. *T T* RECEIVERS, *V* SPRING, *N* MAGNET, *E* NUT, *R* STEEL STRIP, *A* SCREW CLAMPING *R* TO *V*, *d d'* METAL COLLAR CLAMPING *V* TO RECEIVER CASE, *f f* TERMINALS OF COIL *a* CONNECTING SCREW, *c'* SOFT RUBBER NIPPLE FOR EARPIECE.

completely encloses the coil. The two poles are magnetically insulated from each other by the wooden case, to the upper part of which the diaphragm is

48 TELEPHONE HAND BOOK.

appeared on the scene with an application for a patent on a microphonic transmitter, and according to the rules of the Patent Office no patent could be issued to any of the three until it was determined whether the Drawbaugh claim was valid or not. This was finally decided against Drawbaugh, as it was proved that the Edison carbon transmitter had been in public use for more than two years before Drawbaugh made his application for a patent, and his application was thrown out. A patent was then issued to Berliner on the broad

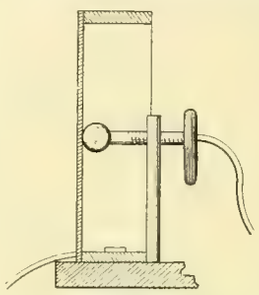


FIG. 44. BERLINER'S FIRST TRANSMITTER.

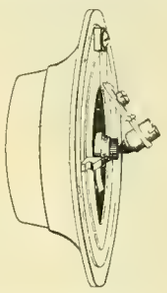


FIG. 45. BERLINER CARBON TRANSMITTER.

principle of the microphone transmitter in November, 1891. In May of the following year a patent was issued to Edison, so that both sides of the interference eventually got their patents—more than fourteen years after the filing of the original applications.

78. Both Berliner and Edison obtained in 1878 patents on special forms of transmitters designed in accordance with the principles laid down in their applications for the broad principle of battery telephones, and the Berliner transmitter especially has been modified out of all semblance to its original form. The broad claim in the Berliner patent is as follows: "The method of producing in a circuit electrical undulations similar in form to sound waves by caus-

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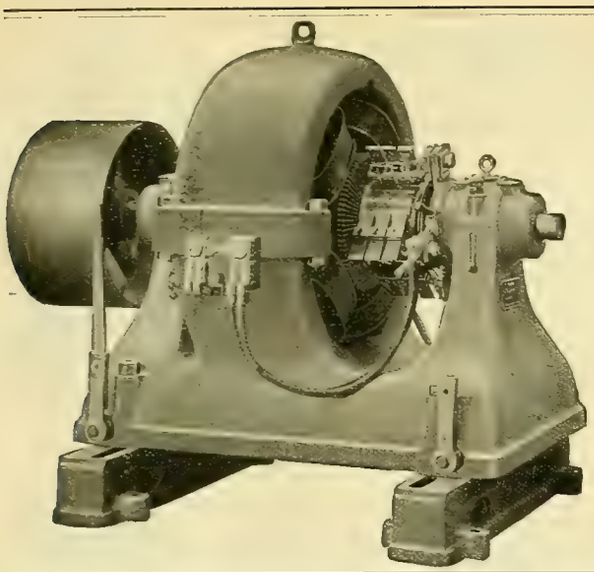

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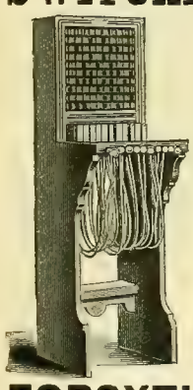

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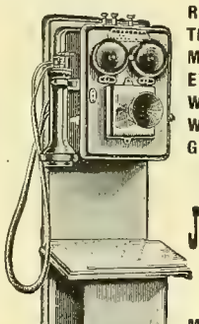

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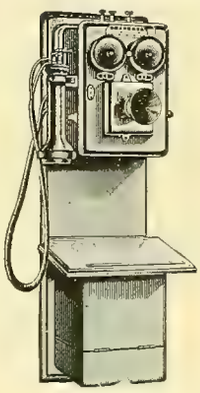

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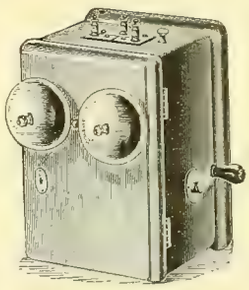

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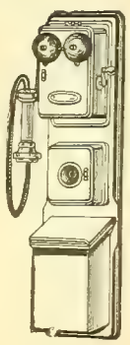

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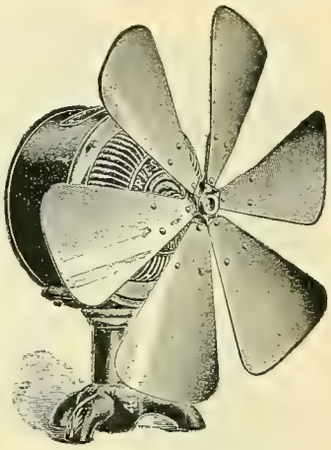

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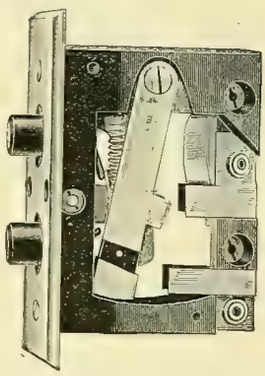

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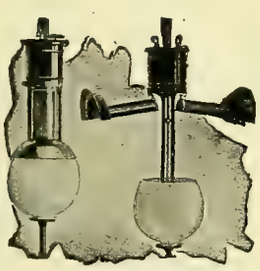

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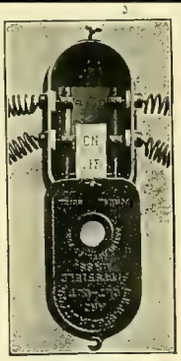

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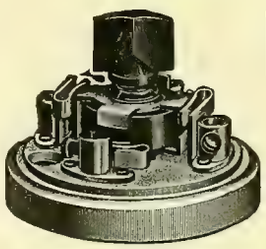

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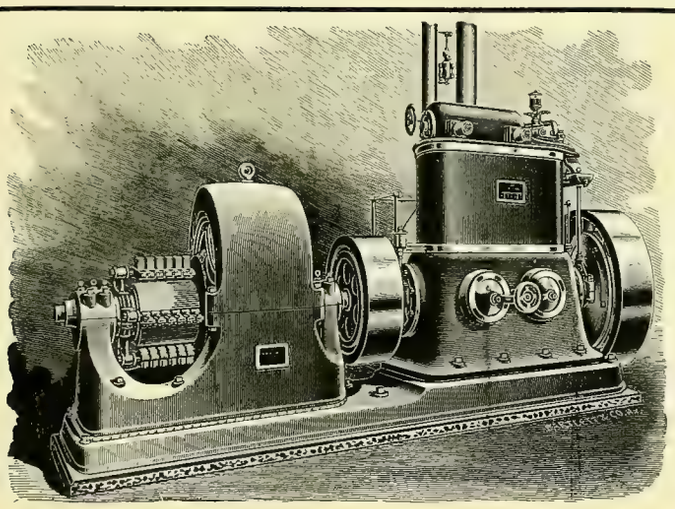

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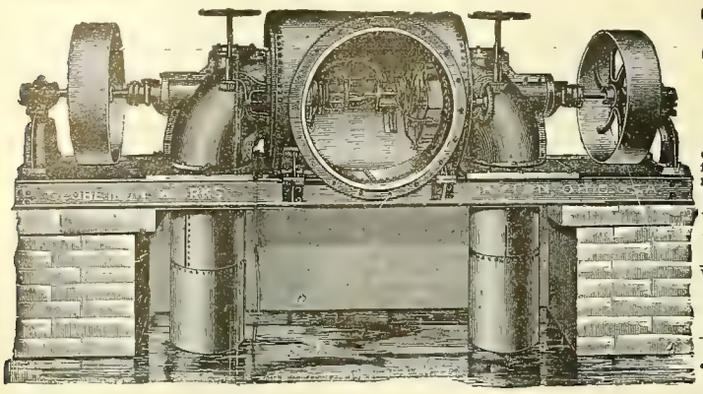

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Recent improvements made in the New American Turbine have increased the power as per their diameter, and produced greater efficiency from whole to half water than any other turbine, as evidenced by the following, copied from certified tests made at Holyoke, Mass., on the dates named, and signed by A. F. Sickman, engineer in charge of experiments, and E. S. Waters, hydraulic engineer.

The originals of these certificates and tests of other sized wheels can be seen at our office.

**Test of a 45-inch Wheel—July 9, 1894.**

| | Head. | Rev. per Min. | Cu. Ft. per Sec. | Horse Power. | P'r Cent |
|---|---|---|---|---|---|
| Whole Gate | 16.06 | 119.17 | 141.58 | 205.27 | 79 76 |
| ⅞ " | 16.42 | 122.00 | 127.18 | 195.19 | 82.55 |
| ¾ " | 16.78 | 117.33 | 112.60 | 175.74 | 82.18 |
| ⅝ " | 17.03 | 111.83 | 98.12 | 149.99 | 79.31 |
| ½ " | 16.88 | 118.67 | 82.07 | 118.40 | 75.52 |

**Test of a 42-inch Wheel—July 14, 1894.**

| | Head. | Rev. per Min. | Cu. Ft. per Sec. | Horse Power. | P'r Cent |
|---|---|---|---|---|---|
| Whole Gate | 16.33 | 128.00 | 134.18 | 199.56 | 80.50 |
| ⅞ " | 16.56 | 134.80 | 120 85 | 188.14 | 83.09 |
| ¾ " | 16.59 | 129.33 | 104.85 | 162.89 | 82.77 |
| ⅝ " | 17.13 | 125.25 | 92 76 | 142.40 | 79 21 |
| ½ " | 17.48 | 121.00 | 70.80 | 98.85 | 70.60 |

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**COMBINE SAFETY WATER TUBE BOILER**
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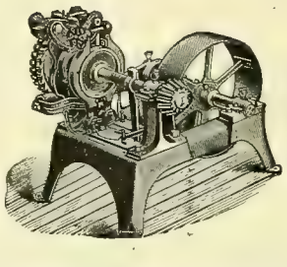

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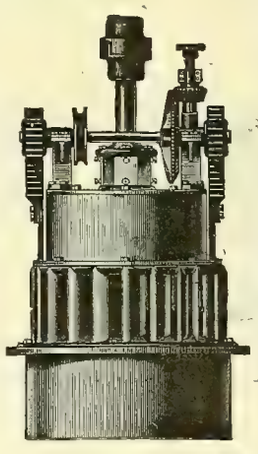

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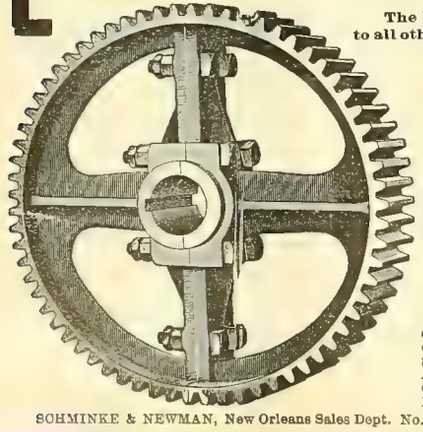

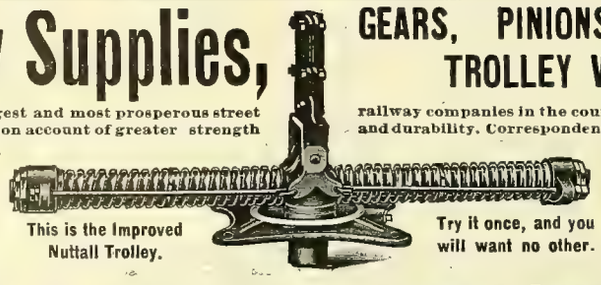

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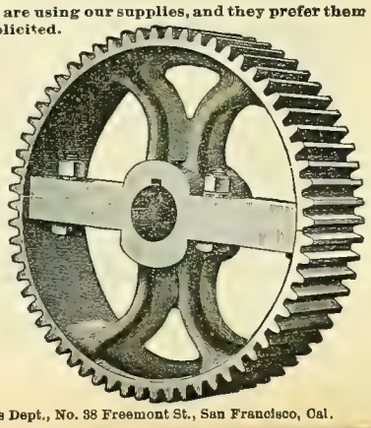

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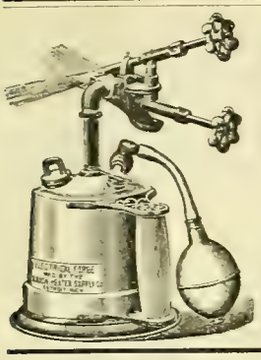

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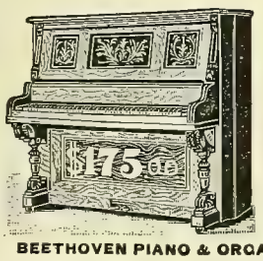

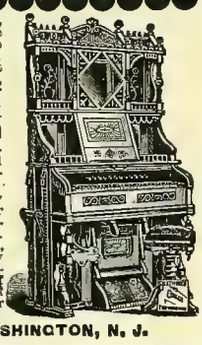

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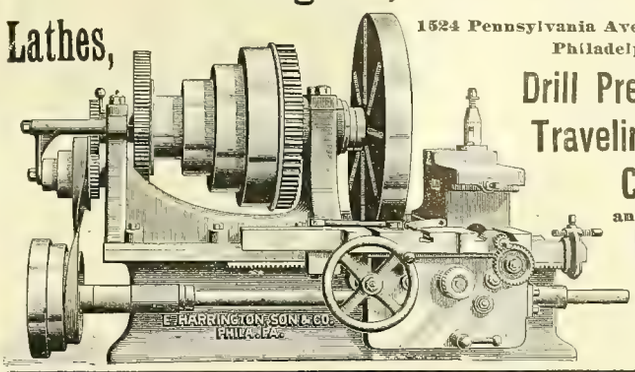


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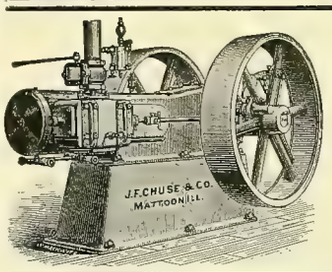


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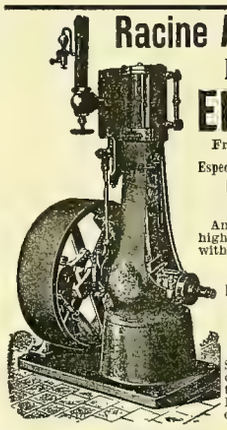

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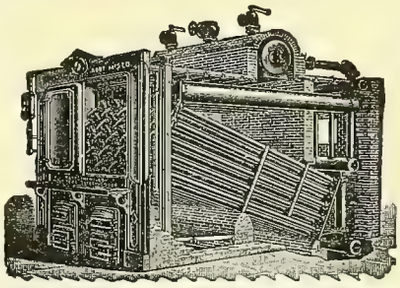

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We are the pioneers of the alternating current system of central station incandescent and arc lighting in America—a result largely due to the excellent mechanical design and construction of our apparatus. In electric railway work the superiority of our multipolar generators, improved motors and controllers, and general power station apparatus, is recognized by the owners and managers of the most successful electric railways.

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**The above advertisements are submitted to all intending purchasers of Electrical Apparatus. The Westinghouse Electric & Mfg. Company has always maintained its position as the leading electrical company in this country, and the fact that even our advertisements are copied by our competitors is excellent testimony of our assertion.**

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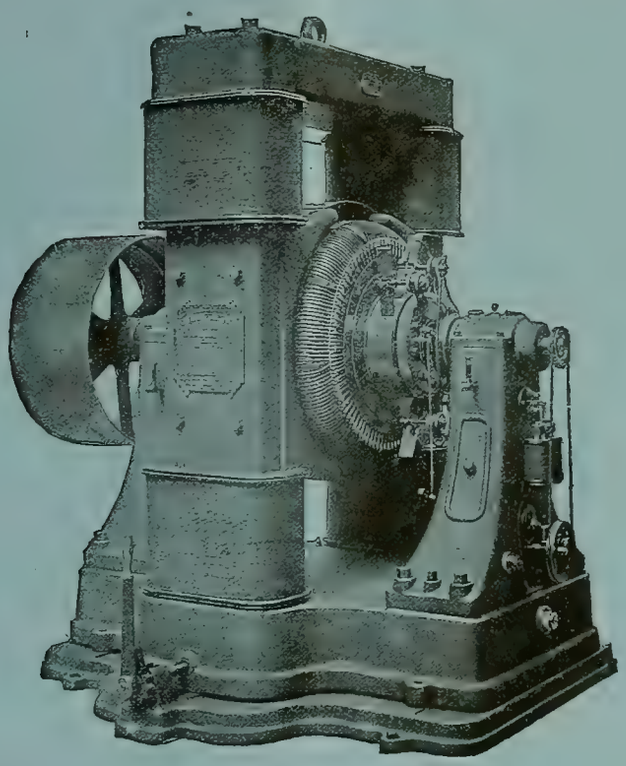

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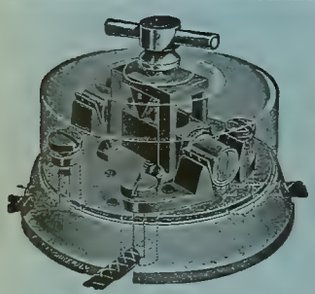

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HAVE COME AND GONE, BUT THE

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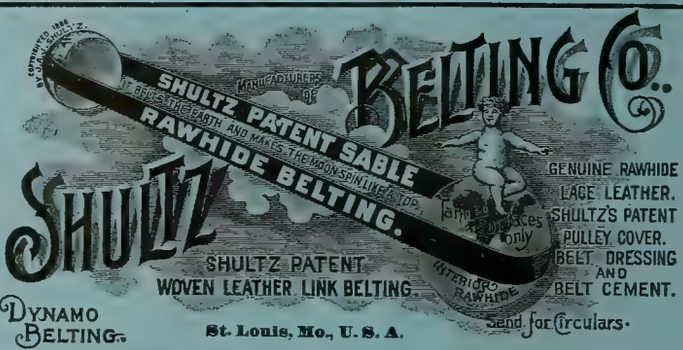
IS STILL THE

PEER OF ALL.

TRY THEM AND WONDER WHY YOU EVER USED ANY OTHER.

O. S. PLATT, - 88-102 Cannon St., Bridgeport, Conn.

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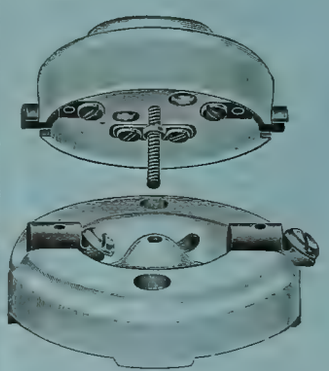

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Manufacturers of all Kinds of Electrical Porcelain.

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Vol. XVII. CHICAGO, OCTOBER 19, 1895. No. 16



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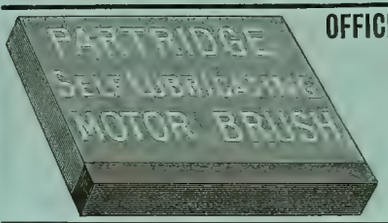


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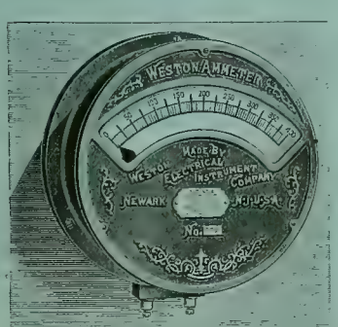


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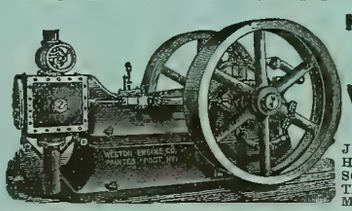

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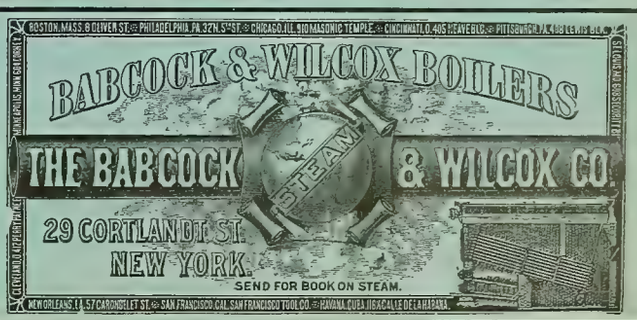


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United Elec. Imp. Co.
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DEALERS IN Electric Lighting **SUPPLIES,** Incandescent Lamps OF ALL CANDLE POWERS.

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Long Life, Efficiency,
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It is Absolutely Non Freezing,
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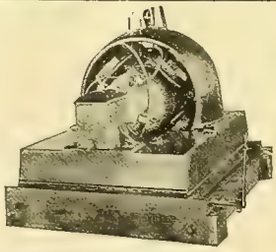

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Reversible Motors and Controllers for Rolling Mills, Bridges and Traveling Cranes.

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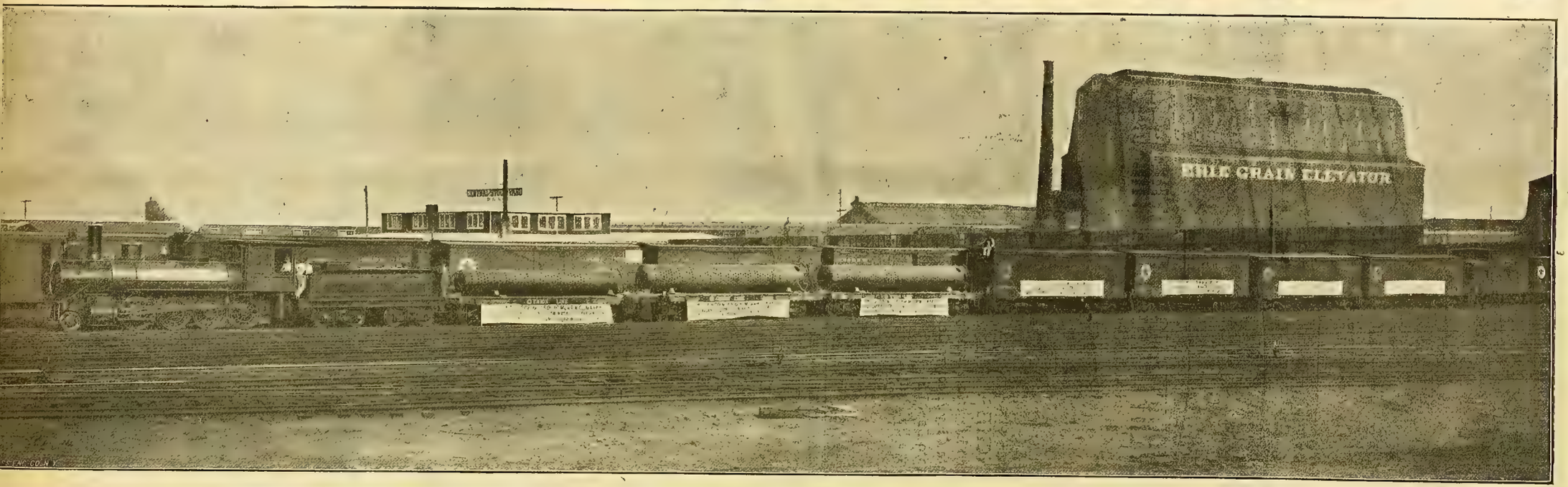


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**IS NO EXPERIMENT.**

EACH LAYER OF THIS ANTI-FRICTION METAL

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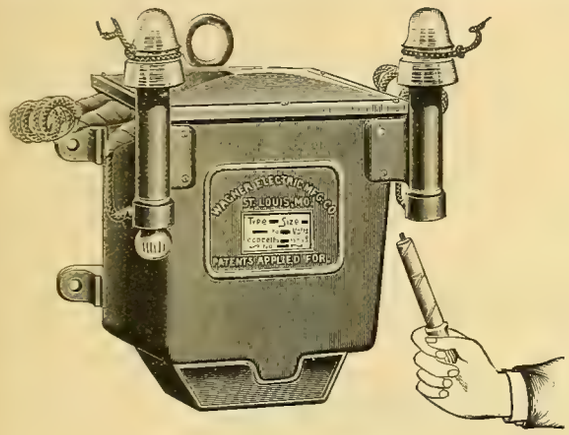


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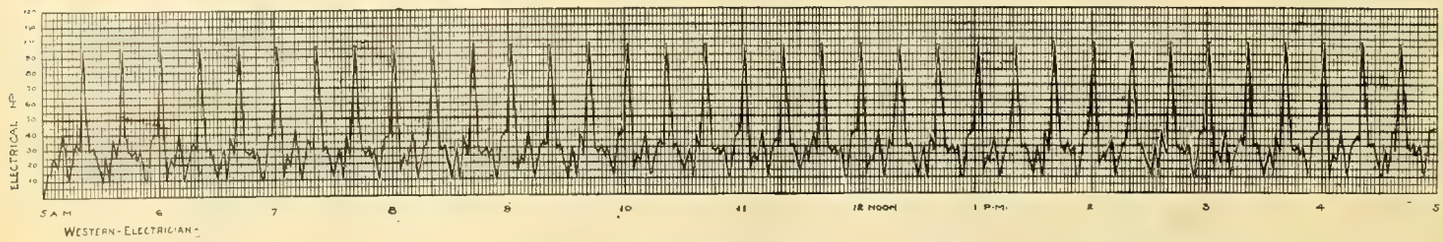
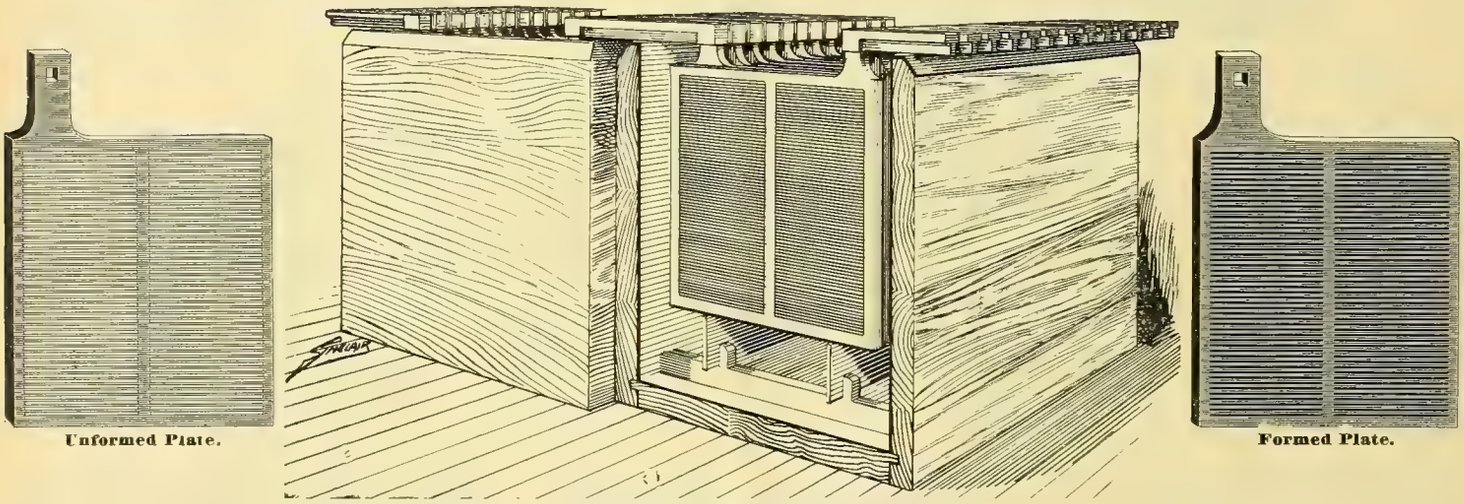
# STORAGE BATTERIES.




**Load diagram of the St. Joseph and Benton Harbor, Mich., Street Railway Company's Plant,** showing how the load varies from an average of 40 H. P. to a maximum of 120 H. P. every 20 minutes, owing to a car reaching a heavy grade at 20-minute intervals. By installing **240 200-Ampere Hour Pumpelly-Sorley Storage Batteries,** the "**load line will be evened up**" and the road will be operated by one 50 H. P. engine, instead of keeping an engine of 250 H. P. in constant operation, as is now done in order to meet the maximum demand. Results: steady load; greater plant efficiency; no strain on machinery; reduced depreciation and **lower coal bills.**

## A "Storage Battery Auxiliary" will do the same for most Electric Railway Plants.



Unformed Plate.

Pumpelly-Sorley Central Station Cell.

Formed Plate.

## Why the Pumpelly-Sorley Battery is Superior to Any Other Storage Battery on the Market:

1st. Because each **plate or electrode** is made from **one integral piece of rolled lead.**
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5th. Because its initial electromotive force is sustained during nearly its entire period of discharge.
6th. Because it has a **higher efficiency.**
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8th. Because it gives **entire satisfaction** wherever used.

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All patent rights for the exclusive manufacture of

# Tudor Storage Batteries

in the United States, and is prepared to furnish Batteries of this type of any desired size.

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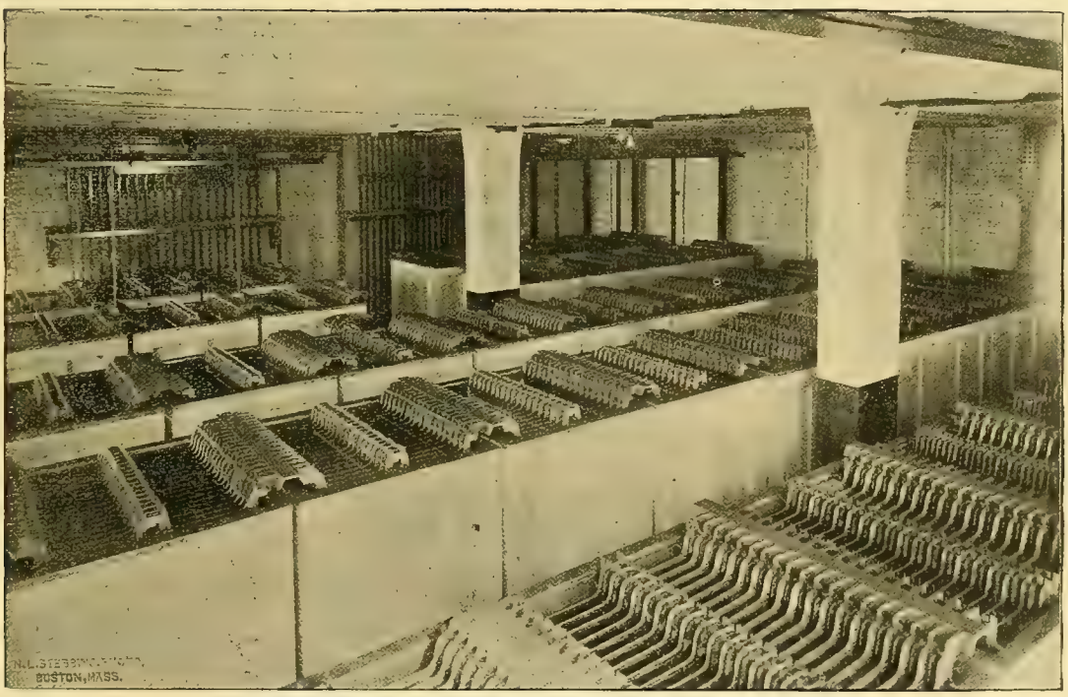
**In Germany and Austria** the TUDOR BATTERY is used in eighty per cent. (80%) of all Central Stations—besides being installed in

## 15 RAILWAY POWER PLANTS and 5000 ISOLATED LIGHTING PLANTS.



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**Storage Batteries are Needed in Central Stations:**

**1st.** To effect reduction in first cost of plant. (Half steam power plant and half Storage Battery Plant costs only three-quarters of what all Steam Plant would cost for same work.)
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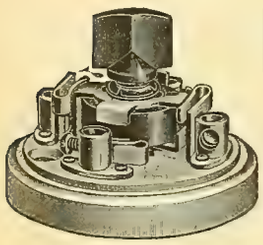
STANDARD SWITCHES, 5 and 10 ampere S. P.
10 amp. 3 and 4-way, 10, 15, 30 and 50 amp. D. P.



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Of any of the above sizes, either on single plates or with any number of switches upon one plate.

*Cut illustrates 4-way or commutation switch, controls a light or group of lights from any desired number of points.*

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# YOU NEED MORE LIGHT.

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*CAN MEET YOUR DESIRE FOR STYLE AND PRICE.*

## "SUN-SCHMELZER-NURNBERG" CARBONS.

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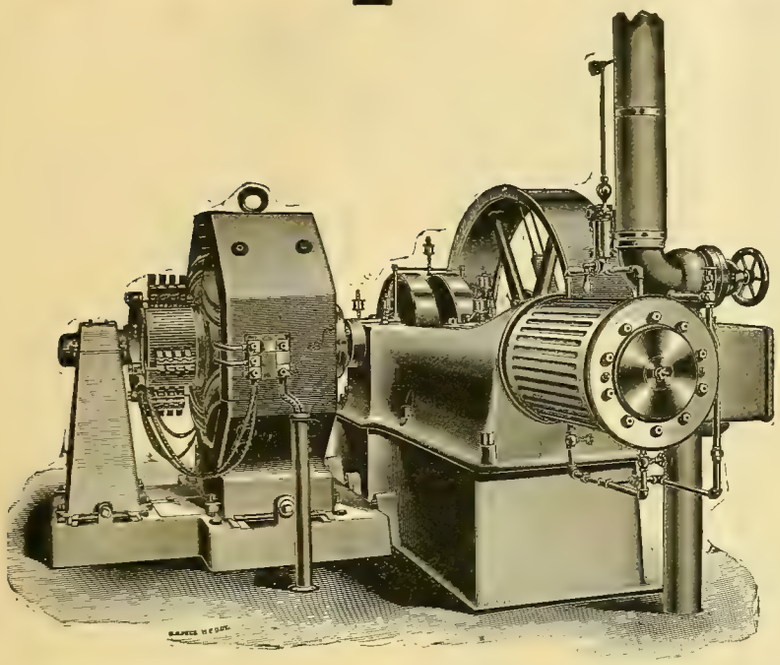

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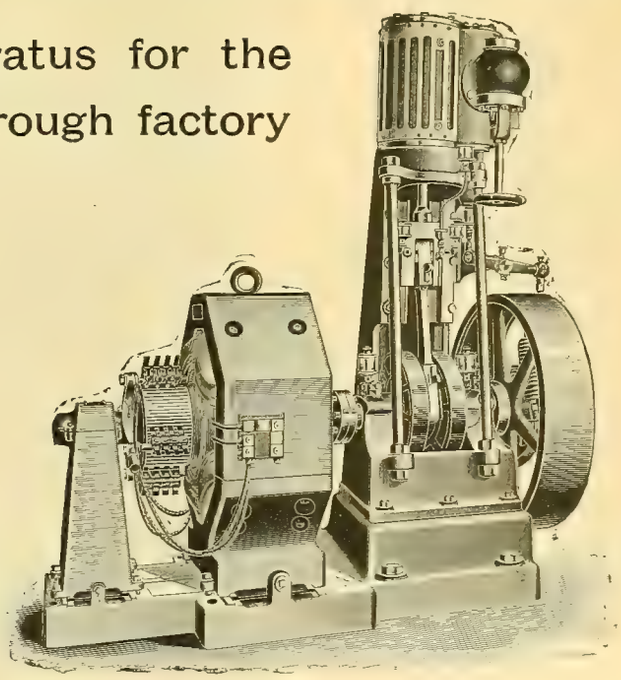

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THE SAME

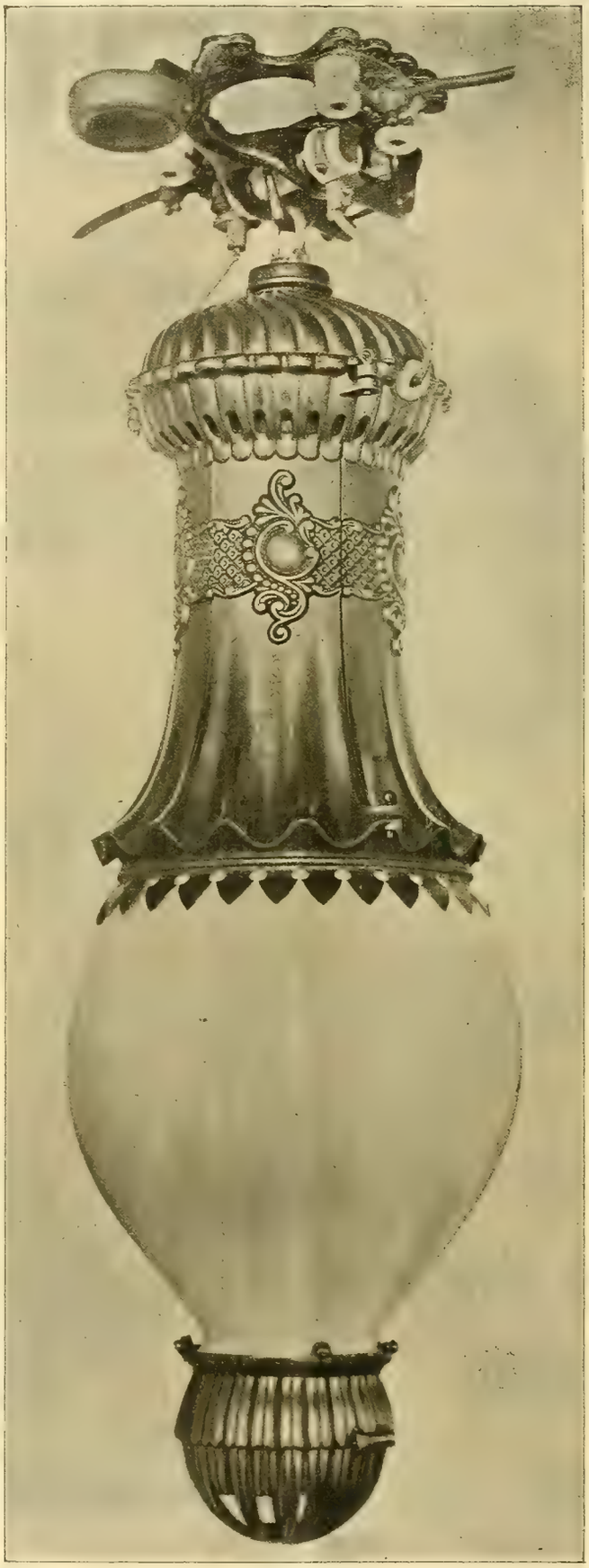
LAMP

OPERATES PERFECTLY ON

EITHER 1,200 OR 2,000

CANDLE POWER CIRCUIT

WITHOUT CHANGE OR ADJUSTMENT.



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SINGLE CARBON, 32-INCH, 14 HOUR LAMP. Changed to Parallel or Alternating in Five Minutes by Changing Coils.

Any Finish, from Black Japan to Aluminum. DESIGN, HANDSOME; OPERATION, PERFECT.

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"A.-B." INCANDESCENTS NEXT WEEK.

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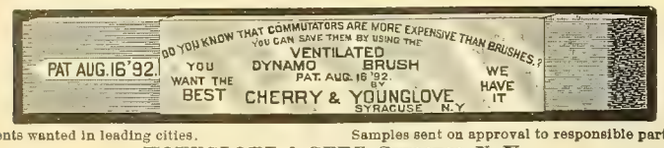
**Manufacturers: INDIANA RUBBER AND INSULATED WIRE COMPANY, Marion, Ind.**

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Ponder the pages of our book; mailed free.

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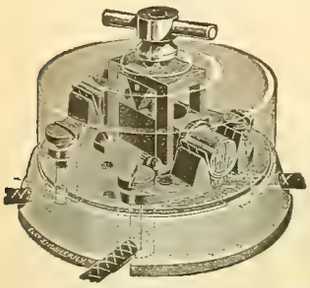

# MANY SWITCHES

HAVE COME AND GONE, BUT THE

## NEW ENGLAND SWITCH

IS STILL THE

## PEER OF ALL.

TRY THEM AND WONDER WHY YOU EVER USED ANY OTHER.

**O. S. PLATT, - 88-102 Cannon St., Bridgeport, Conn.**

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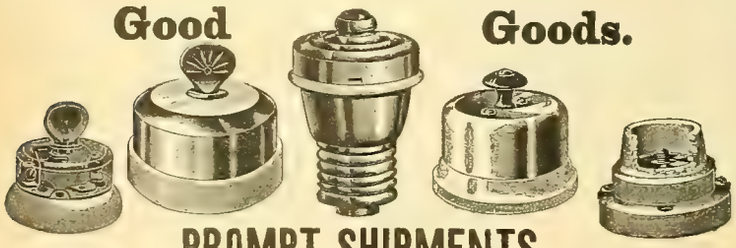

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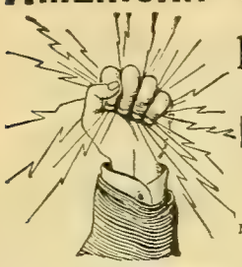

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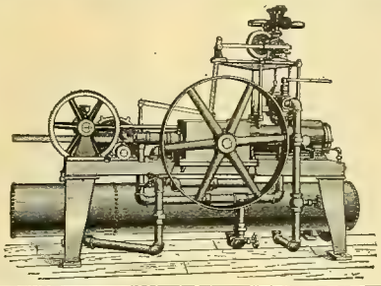

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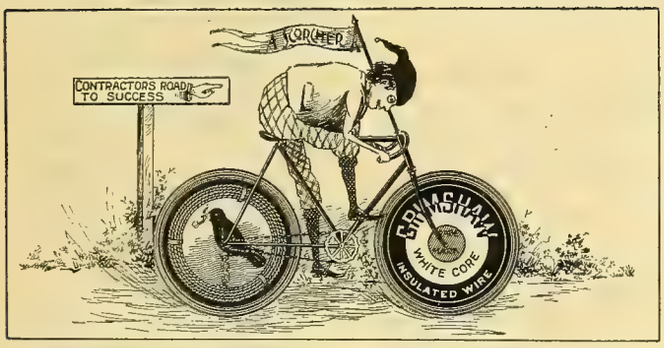


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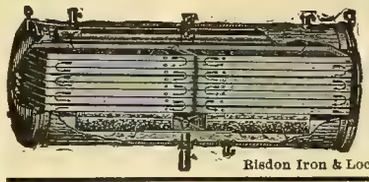

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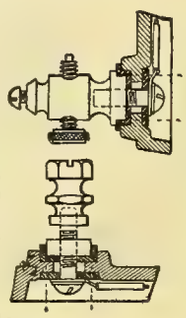

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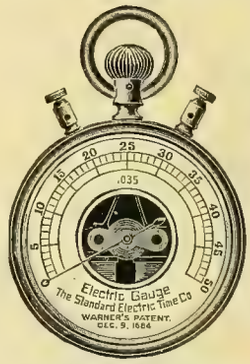


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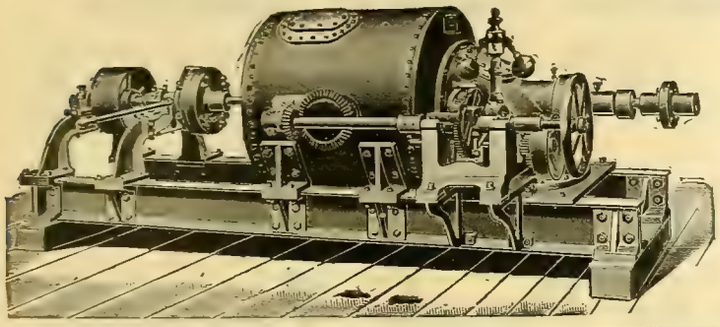

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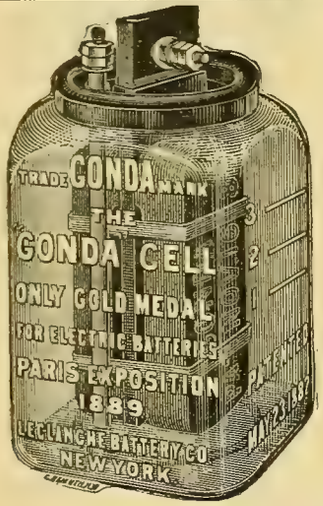


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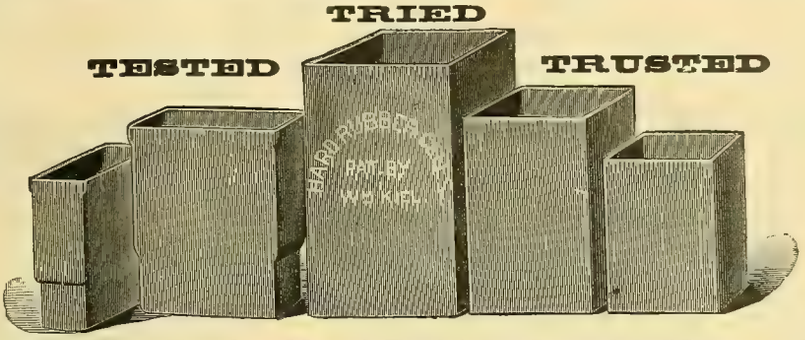

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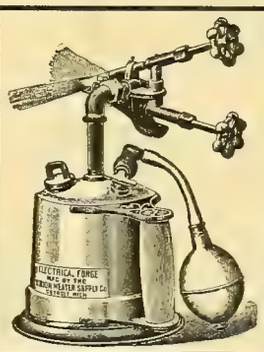


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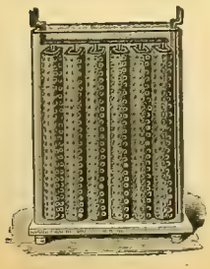

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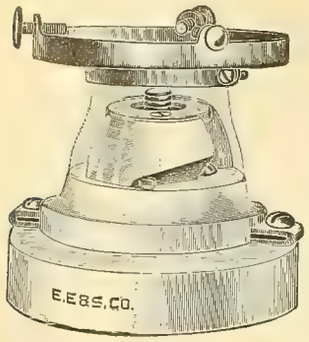


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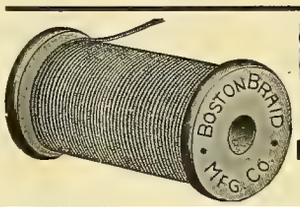


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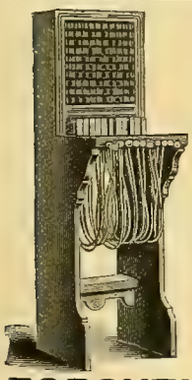

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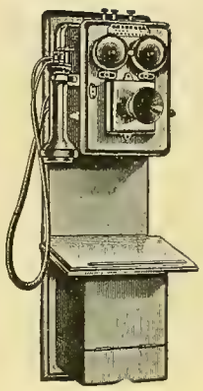

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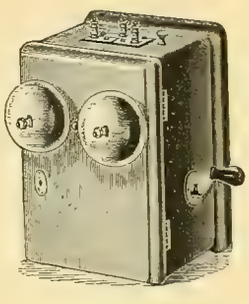

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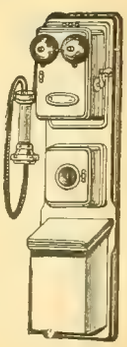

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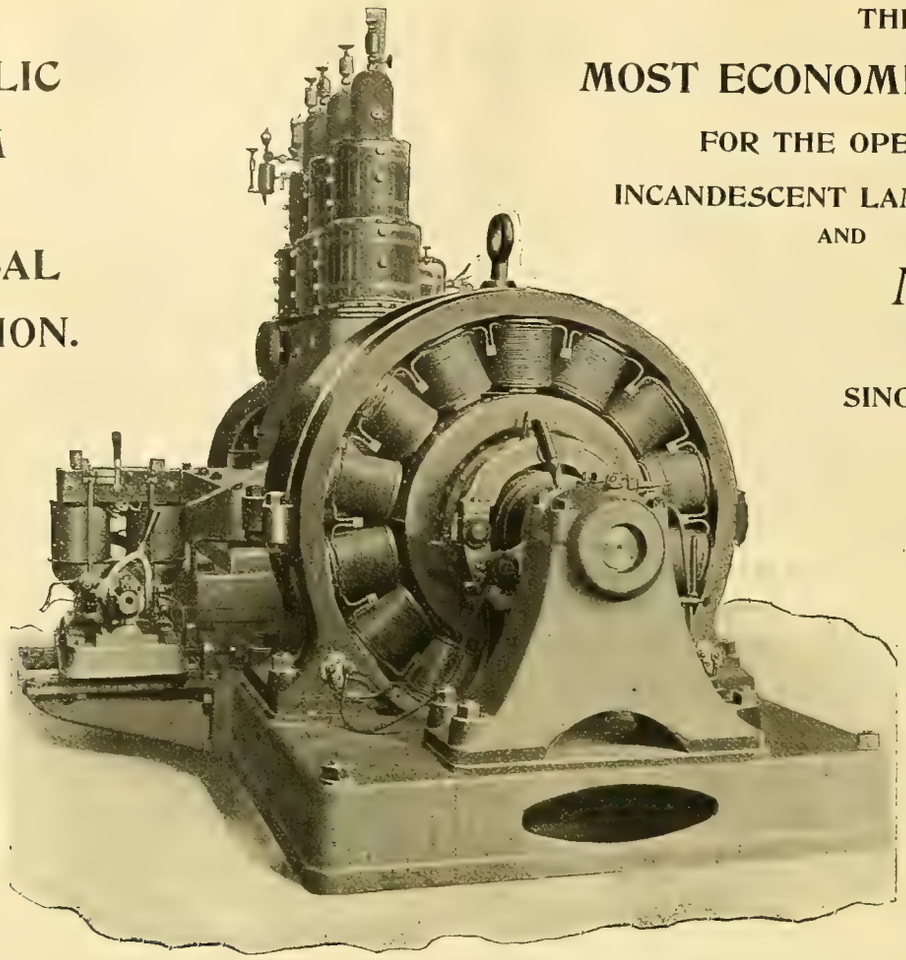

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Embody the following ADVANTAGES:

Shortest Lamp on the market with longest life.
Stationary Arc.
Short-circuiting absolutely impossible.
Will never take more current than they are built for.
Will not see-saw.
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Our 14-hour Lamp is 33 inches long over all.

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We make a specialty of Short Lamps for low=ceiling stores.

We manufacture Lamps for Direct and Alternating Currents (high and low tension) and railway circuits.

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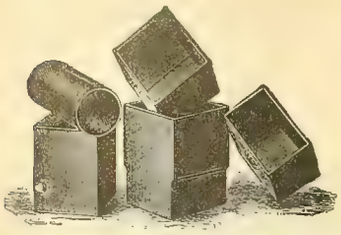

# THE FREEMAN

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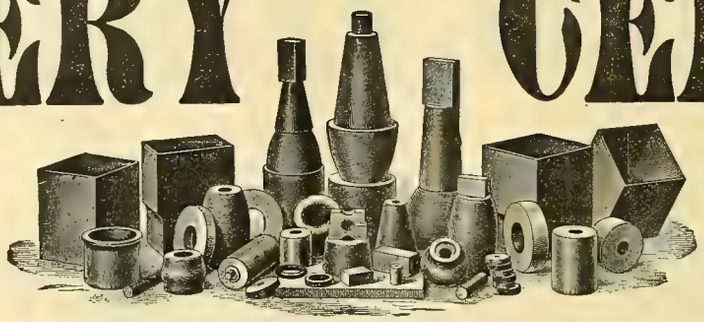

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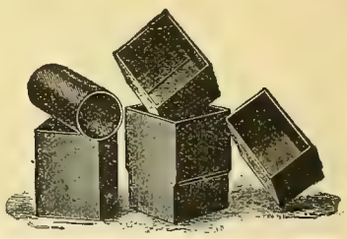

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The motors excel in simplicity of construction; in starting torque and simplicity of starting device; in efficiency in the manner in which they take current in proportion to their load, and in uniformity of speed under different conditions of load.

Our transformers insure satisfactory service and the greatest economy. We are prepared to fill all orders promptly, and carry a full stock of transformers in Chicago.

**Patents**—Our apparatus is novel, different from anything heretofore made, and covered by patents that fully protect us and our customers. We are not infringing patents belonging to others, and shall avail ourselves of the patents under which we operate to protect ourselves from piracy by other manufacturers.

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**The Helios Electric Company claims:**

That they have more alternating arc lamps in use than all other makes combined.

They guarantee 80 per cent. more available light than is obtained from any other alternating arc lamp.

They guarantee to give as much light as any direct current lamp using the same number of watts.

## Spencer's Improved Alternating Arc Lamp

**Possesses the following advantages:**

Minimum choke in the regulating coil.
Practically no energy absorbed in the regulating device.
Durability of all its parts; not liable to get out of order.
Can be used successfully on all periods.
Starts quickly.

## Spencer's Direct Current Constant Potential Lamp.

**Guaranteed not to see-saw.**

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We guaranteed to evaporate 10¼ lbs. water per pound of Pittsburg coal. We showed 10¾ lbs.

We will guarantee you the same, under heavy forfeit for failure.

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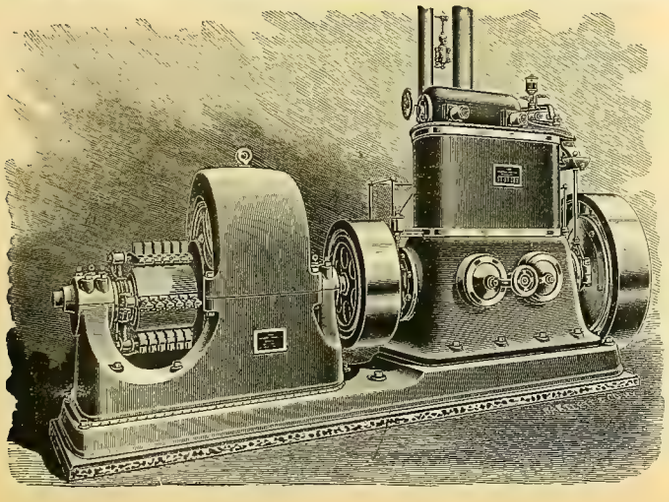

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# HIGH EFFICIENCY
*ARE EQUIPPED WITH*
# WESTINGHOUSE ENGINES.

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**COMPOUND, 5 to 1,000 H. P.,** Unequaled adaptability, high fuel duty and moderate cost.
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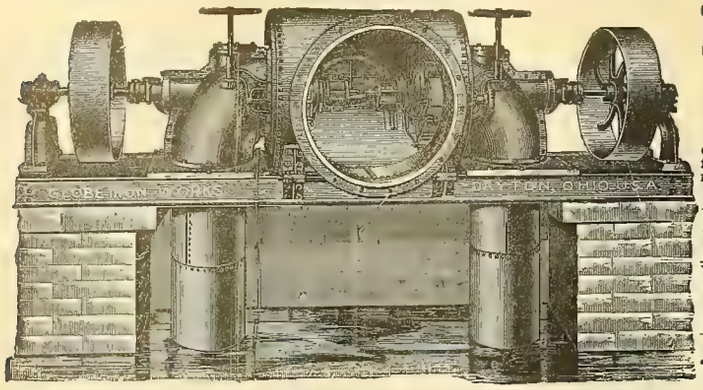
All Offices of the Westinghouse Electric & Mfg. Co. | And All Foreign Countries.

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Recent improvements made in the New American Turbine have increased the power as per their diameter, and produced greater efficiency from whole to half water than any other turbine, as evidenced by the following, copied from certified tests made at Holyoke, Mass., on the dates named, and signed by A. F. Stickman, engineer in charge of experiments, and E. S. Waters, hydraulic engineer.

The originals of these certificates and tests of other sized wheels can be seen at our office.

**Test of a 45-inch Wheel—July 9, 1894.**

| | Head. | Rev. per Min. | Cu. Ft. per Sec. | Horse Power. | P'r Cent |
|---|---|---|---|---|---|
| Whole Gate | 16.06 | 119.17 | 141.58 | 205.27 | 79.76 |
| ⅞ " | 16.42 | 122.00 | 127.18 | 195.19 | 82.58 |
| ¾ " | 16.78 | 117.33 | 112.60 | 175.74 | 82.18 |
| ⅝ " | 17.03 | 111.83 | 98.12 | 149.99 | 79.31 |
| ½ " | 16.88 | 118.67 | 82.07 | 118.40 | 75.52 |

**Test of a 42-inch Wheel—July 14, 1894.**

| | Head. | Rev. per Min. | Cu. Ft. per Sec. | Horse Power. | P'r Cent |
|---|---|---|---|---|---|
| Whole Gate | 16.33 | 128.00 | 134.18 | 199.56 | 80.50 |
| ⅞ " | 16.66 | 134.80 | 120.85 | 188.14 | 83.09 |
| ¾ " | 16.59 | 129.33 | 104.85 | 162.89 | 82.77 |
| ⅝ " | 17.13 | 125.25 | 92.76 | 142.40 | 79.21 |
| ½ " | 17.48 | 121.00 | 70.80 | 98.85 | 70.60 |

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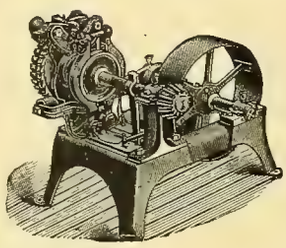

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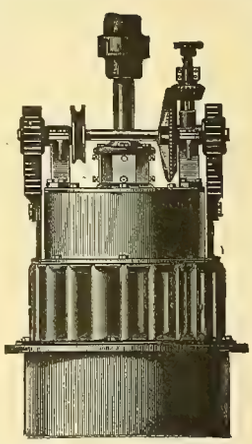

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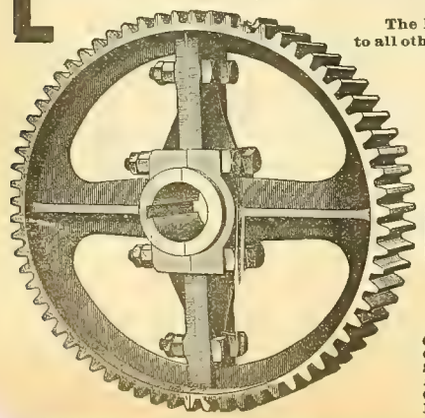

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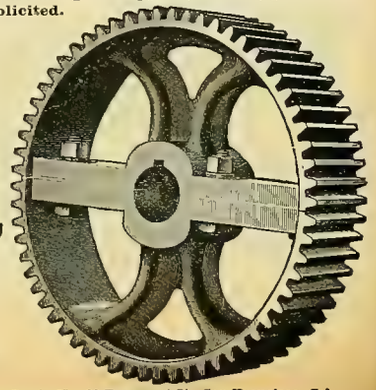

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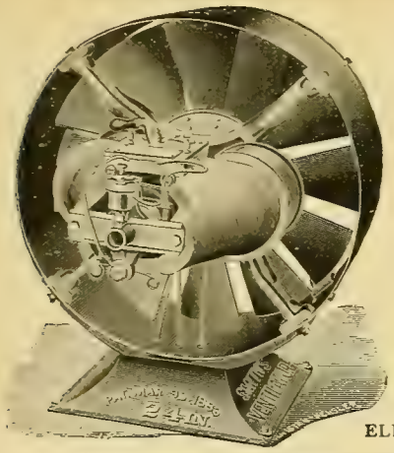

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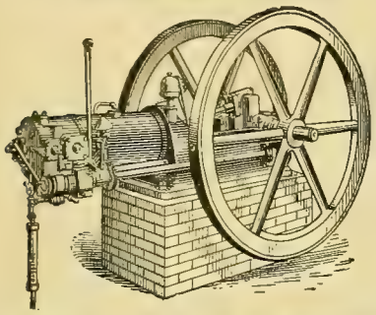

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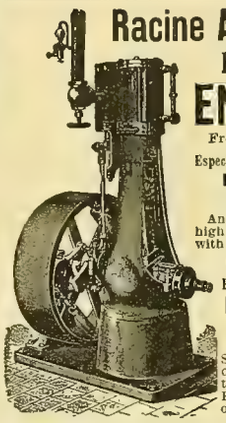

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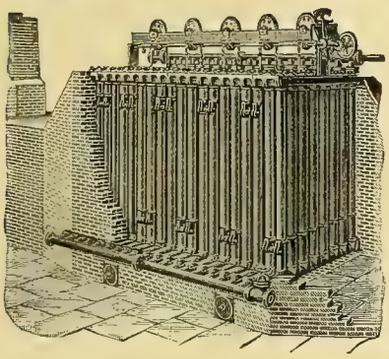

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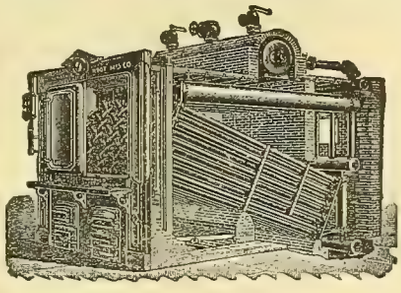

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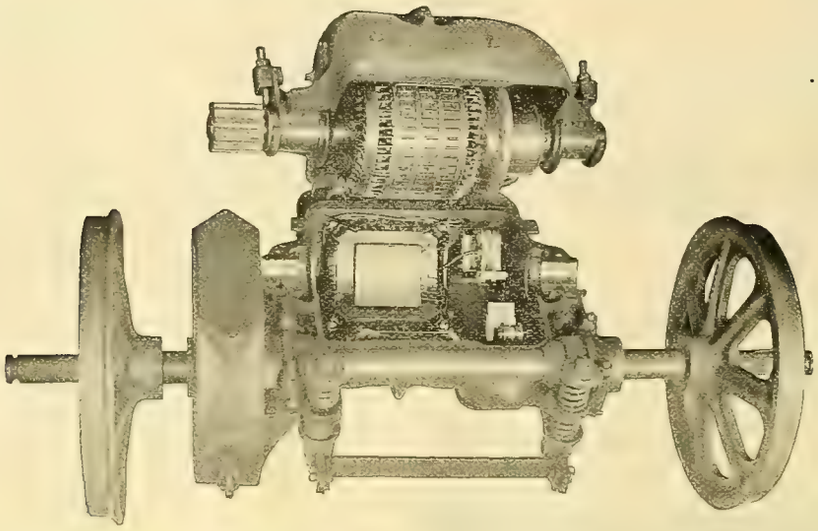

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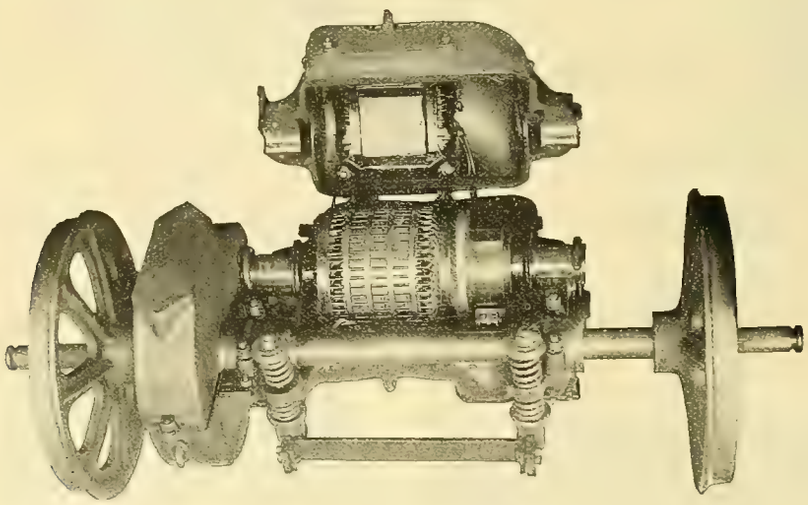

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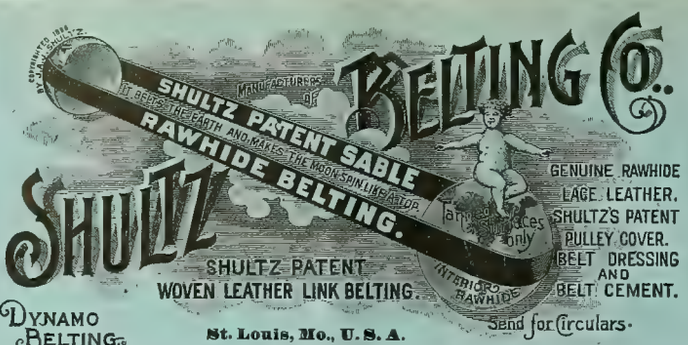


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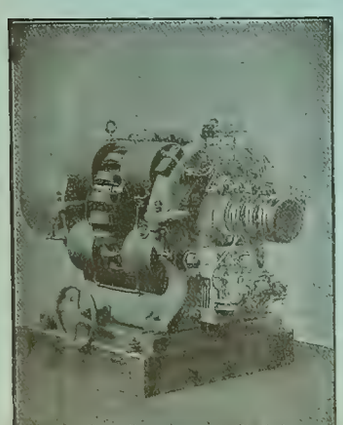

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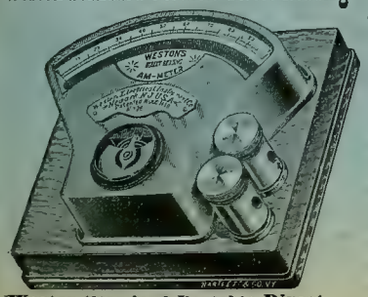

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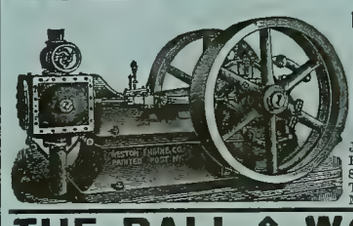

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Complete Power Plants.

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MITCHELL, LEWIS & STAVER CO., Seattle, Wash.

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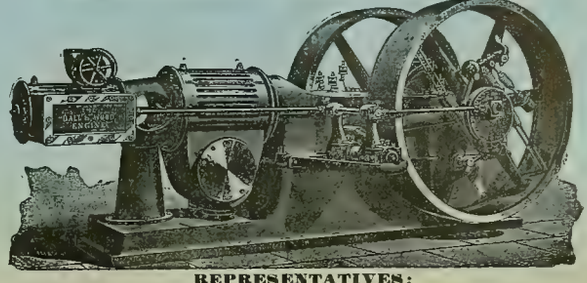
Builders of Improved Automatic Cut-off Engines.



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## CLASSIFIED LIST.


**Accumulators.**
Electric Storage Battery Co.
Ohio Storage Battery Co.
Pumpelly-Sorley S. B. Co.

**Aluminum.**
Pittsburg Reduction Co,

**Annunciators.**
Central Electric Co.
Chicago Gen'l Fixture Co.
Electric Appliance Co.
Ostrander & Co., W. R.
Partrick & Carter Co.

**Arc Lamps.**
Adams-Bagnall Elec. Co.
Auerbach-Woolverton El.Co.
Central Electric Co.
Chicago Gen'l Fixture Co.
Corey, R. B.
Crocker-Wheeler Elec. Co.
Ft. Wayne Elec. Corporation
General Electric Co.
Gen'l. Inc. Arc Lt. Co.
Greene, O. B.
Helios Electric Co.
Solar Electric Co.
Standard Electric Co.
Standard Thermometer Co.
Waterman, C. H.
Westinghouse El. & Mfg. Co.

**Arc Light Cord.**
Samson Cordage Wks.

**Batteries and Jars**
Andrae & Sons, J.
Boynton Multivolt Batt'y Co.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Central Electric Co.
Chicago Gen'l Fixture Co.
Edgerton Pottery Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric-Power Storage Co.
Electric Storage Battery Co.
Gordon-Burnham Bat. Co.
Hemingray Glass Co.
Leclanche Battery Co., The.
Miamisburg Electric Co
Newton Rubber Wks.
Ohio Storage Battery Co.
Partrick & Carter Co.
Peru Elec. Mfg. Co.
Pumpelley-Sorley S. B. Co.
Western Electric Co.

**Bells.**
Andrae & Sons, J.
Central Electric Co.
Electric Appliance Co.
Huebel & Manger.
Ostrander & Co., W. R.
Partrick & Carter Co
Western Electric Co.

**Belting.**
Shultz Belting Co.

**Blow Torches.**
Union Heater Supply Co.

**Boilers.**
Abendroth & Root Mfg. Co.
Babcock & Wilcox Co., The.
Clonbrock Steam Boiler Co.
Hogan Boiler Co.
Moyes, L. M.
Racine Hardware Co.
Weston Engine Co.

**Books, Electrical.**
Electrician Publishing Co.

**Bronze.**
Besly & Co., Chas. H.
Phosphor Bronze Sm.Co.,Ltd.

**Brushes.**
Boudreaux Dyn. Brush Co.
Central Electric Co.
Partridge Carbon Co.
Solar Carbon & Mfg. Co.
Younglove & Gere.

**Burglar Alarms.**
Central Electric Co.
Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

**Cables** (See Insulated Wires.)

**Cables, Electric** .(See Insulated Wires), **Copper, Sheet and Bar.**
American Elec. Works.
Brixey, W. R.
Central Electric Co.
Eastern Electric Cable Co.
Elec. Engr. & Supply Co.
Moore, Alfred F.
New York Ins. Wire Co.
Safety Insul. & Cable Co.
Simplex Electrical Co.
Standard Underground C.Co.
Western Electric Co.

**Carbons, Points & Plates.**
Central Electric Co.
Chicago Gen'l Fixture Co.
Corey, R. B.
General Electric Co.
Greene, O. B.
Hardtmuth & Co., F.
Partridge Carbon Co.
Reisinger, Hugo.
Solar Carbon & Mfg. Co.
Wertheim Ed.
Western Electric Co.

**Clocks, Watchmen's.**
Southgate & Co., W. B.

**Compound.**
Chisholm & Co., A.
Standard Paint Co.

**Conduits.**
Am. Circular Loom Co.
Central Electric Co.
Interior Conduit & Ins. Co.

**Construction & Repairs.**
Crocker-Wheeler Elec. Co.
Ft. Wayne Elec. Corporation.
Hartley Elec. Wks.
Homer & Co, F. E.
Royal Electric Co.

**Contractors and Electric Light Plants.**
Arnold, B. J.
Bain, Foree.
Brush Electric Co.
Bryan, Wm. H.
Card Electric Co.
Chic. Elec.-Mech. Ent. Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Royal Electric Co.
Schott, W. H.
Sells, O. P.
Siemens & Halske Elec. Co.
Standard Electric Co.
United Elec Improvement Co
Westinghouse Elec & Mfg. Co.
Western Electric Co.

**Copper.**
Besly & Co., Chas. H.

**Copper Wire Bought.**
Swarts Metal Refining Co.

**Copper Wires.**
American Electrical Works.
Besly & Co., Chas. H.
Brixey, W. R.
bunnell & Co., J. H.
Central Electric Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.
National India Rubber Co.
Okonite Co. The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Western Electric Co.

**Cordage.**
Samson Cordage Wks.

**Cranes.**
Harrington, Son & Co., E.

**Cross-Arms, Pins and Brackets.**
Anderson, Albert & J. M.
Brady, T. H.
Central Electric Co.
Central Mfg. Co.
Electric Appliance Co.
Elec Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Nuttal Co., R. D.
Partrick & Carter Co.

**Cut-Outs and Switches.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Bryant Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Edison Co.
Chicago Gen'l Fixture Co.
Colgate Co., Geo. L.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric Protection Co.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Forest City Elec. Wks.
Forsyth & Fisk.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hart & Hegeman Mfg. Co.
Huebel & Manger.
Interior Conduit & Ins. Co.
Louisville Elec. Wks.
MacCurdy & Smith.
Nuttall Co., R. D.
Partrick & Carter Co.
Peru Elec. Mfg. Co.
Platt, O S.
Royal Electric Co.
Solar Electric Co.
Wagner Elec. Mfg. Co.

**Desks.**
Ithaca Desk Co.

**Dynamos.**
Brush Electric Co.
Card Electric Co.
Central Electric Co.
Colburn El. Mfg. Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Fontaine Crossing & El. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hartley Elec. Wks.
Interior Conduit & Ins. Co.
Roth Bros. & Co.
Royal Electric Co.
Siemens & Halske Elec. Co.
Standard Electric Co.
Walker Mfg. Co.
Western Electric Co.
Westinghouse Elec. & Mfg.Co.

**Economizers.**
Fuel Economizer Co.

**Electric Railways.**
Brush Electric Co.
Card Electric Co.
General Electric Co.
Siemens & Halske Elec. Co.
Westinghouse El. & Mfg. Co.

**Electrical and Mechanical Engineers.**
Arnold, B J.
Bain, Foree.
Bryan, Wm. H
Chic. Elec.-Mech. Ent. Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Schott, W. H.
Sells, O. P.

**Electrical Instruments.**
Anderson, Albert & J. M.
Bunnell & Co., J. H.
Central Electric Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Interior Conduit & Ins. Co.
Nuttall Co., R. D.
Partrick & Carter Co.
Platt, O. S
Queen & Co. Inc.
Southgate & Co., W. B.
Weston Electrical Inst. Co.
Whitney Elec. Inst. Co.

**Electrical Specialties.**
Electric Protection Co.
S. K. C. Specialty Co.

**Electroliers, etc.**
Edwards, W. S. Mfg. Co.

**Electro-Plating Mach'y.**
Besly & Co., Chas. H.
Colburn El. Mfg. Co.
General Electric Co.

**Engines, Gas.**
Otto Gas Engine Wks.

**Engines, Steam.**
Ball & Wood Co., The.
Chuse & Co., J. F.
Racine Hardware Co.
Westinghouse Machine Co.
Weston Engine Co.

**Engravers.**
Chic. Electro & Stereo Co.
Ill. Engraving Co.

**Fan Outfits.**
Central Electric Co.
Interior Conduit & Ins. Co.
Roth Bros. & Co.

**Feed Water Heaters.**
Goubert Mfg. Co.

**Fibre.**
Butler Hard Rubber Co.
Vulcanized Fibre Co.

**Files.**
Barnett Co., G. & H.

**Filters, Oil.**

**Fire Alarms.**
Partrick & Carter Co.
Western Electric Co.

**Forges.**
Union Heater Supply Co.

**Fuse Wire.**
Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.

**Gas Lighting, Electric.**
Partrick & Carter Co.

**Gears.**
Besly & Co., Chas. H.
Nuttall Co., R. D.

**General Elec. Supplies.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Besly & Co., Chas. H.
Bryant Electric Co.
Bunnell & Co., J. H.
Central Electric Co.
Chicago Edison Co.
Chicago Gen'l Fixture Co.
Colgate Co., Geo. L.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric Protection Co.
Farr Tel. & Const. Supply Co.
Forest City Elec. Wks.
General Electric Co.
Interior Conduit & Ins. Co.
Louisville Elec. Wks.
MacCurdy & Smith.
Metropolitan Electric Co.
Partrick & Carter Co.
Peru Elec. Mfg. Co.
Platt, O. S.
Queen & Co. Inc.
Sioux City Brass Works.
S. K. C. Specialty Co.
Solar Electric Co.
Standard Tel. & Elec. Co.

**Globes and Electrical Glassware.**
Edgerton Pottery Co.
Edwards, W. S. Mfg. Co.
Peru Elec. Mfg. Co.

**Gov'nors, Water Wheel.**
Lombard Water Wheel Gov. Co.

**Graphite Specialties.**
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.

**Hard Rubber Goods.**
Butler Hard Rubber Co.
Fiberite Co.. The.
Newton Rubber Wks.

**Heating, Electric.**
Bowen, W. J.
Whittingham El. Car H. Co.

**Insulators and Insulating Materials.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Brixey, W. R.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Central Electric Co.
Chisholm & Co., A.
Crocker-Wheeler Elec. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Empire China Works.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Grothwell, A.
Hart & Hegeman Mfg. Co.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Louisville Elec. Wks.
MacCurdy & Smith.
Munsell & Co., Eugene.
National India Rubber Co.
Newton Rubber Wks.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Partrick & Carter Co.
Peru Elec. Mfg. Co.
Phillips Insulated Wire Co.
Platt, O. S.
Simplex Electrical Co.
Standard Paint Co.
Standard Underground C.Co.

**Insulated Wires and Cables—Magnet Wire.**
American Electrical Works.
Brixey, W. R.
Bunnell & Co., J. H.
Central Electric Co.
Eastern Electric Cable Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
General Electric Co.
Independent Electric Co.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C.Co.

**Lamps, Incandescent.**
Adams-Bagnall Elec. Co.
Am. Electrical Mfg. Co.
Beacon Lamp Co.
Buckeye Electric Co.
Central Electric Co.
Columbia Inc. Lamp Co.
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Globe Electric Light Co.
New York & Ohio Co.
Partrick & Carter Co.
United Elec. Imp. Co.
Westinghouse Elec. & Mfg Co.

**Lightning Arresters.**
Colgate Co., Geo. L.
Diamond Electric Co.
Electric Appliance Co.
General Electric Co.

**Machinery Wipers.**
Am. Silk Mfg. Co.

**Magnet Wire.**
(See Insulated Wires.)

**Mechanical Machinery.**
Am. Tool & Machine Co.
Besly & Co., Chas. H.
Harrington, Son & Co., E.
Lukens Iron & Steel Co.

**Mica.**
Johns Mfg. Co., H. W.
Munsell & Co. Eugene.

**Mining Apparatus, Elec.**
General Electric Co.
Independent Electric Co.
Westinghouse El. & Mfg. Co.

**Motors.**
Andrae & Sons, J.
Brush Electric Co.
Card Electric Co.
Central Electric Co.
Colburn El. Mfg. Co.
Crocker-Wheeler Elec. Co.
Eddy Elec. Mfg. Co.
Elec. Engr. & Supply Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hartley Elec. Wks.
Interior Conduit & Ins. Co.
Roth Bros. & Co.
Royal Electric Co.
Sioux City Brass Works.
Standard Electric Co.
Stanley Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
Walker Mfg. Co.
Westinghouse El. & Mfg Co.

**Packing.**
Besly & Co., Chas. H.
Garlock Packing Co.

**Paints.**
Grothwell, A.
MacCurdy & Smith
Standard Paint Co.

**Phosphor Bronze.**
Phosphor Bronze Sm.Co Ltd

**Pianos and Organs.**
Beethoven Piano & Organ Co.

**Platinum.**
Baker & Co.

**Poles.**
Morris, Tasker & Co.
Nuttall Co., R. D.

**Porcelain.**
Empire China Works.
General Electric Co.
Peru Elec. Mfg. Co.

**Publishers, Electrical.**
Electrician Publishing Co.

**Push Buttons.**
Central Electric Co.
Electric Appliance Co.
Partrick & Carter Co.

**Rheostats.**
Central Electric Co.
General Electric Co.
Royal Electric Co,

**Sal Ammoniac.**
Klipstein & Co., A.

**Speaking Tubes.**
Central Electric Co.
Electric Appliance Co.
Ostrander & Co., W. R
Partrick & Carter Co.

**Speed Indicators**
Besly & Co., Chas. H.
Colgate Co., Geo. L.
Queen & Co., Inc.
Weston Electrical Inst. Co.
Whitney Elec. Inst. Co.

**Springs.**
Barnes, Wallace.

**Steam Heating.**
Goubert Mfg. Co.
Webster & Co., Warren.

**Storage Batteries.**
Electric Storage Battery Co.
Ohio Storage Battery Co.
Pumpelly-Sorley S. B. Co.

**Street Cars.**
Brill, J. G. Co.

**Tapes, Insulating.**
American Electrical Works.
Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co.
Okonite Co., The.
Simplex Electrical Co.
Standard Paint Co.

**Telegraph Apparatus.**
Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

**Telephones and Telephone Material.**
Andrae & Sons, J.
Central Electric Co.
Dudley Elec. Mfg. Co.
Farr Tel. & Const. Supply Co
Forsyth & Fisk.
Gustafson, W. A.
Keystone Telephone Co.
Mo. Telephone Mfg. Co.
Standard Tel. & Elec. Co.
U. S. Tel. Const. Co.
Western Electric Co.
Western Tel. Const. Co.

**Transformers.**
Central Electric Co.
Chicago Gen'l Fixture Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hartley Elec. Wks.
Louisville Elec. Wks.
Royal Electric Co.
Stanley Electric Mfg. Co.
Wagner Elec. Mfg. Co.

**Trolley Cord.**
Samson Cordage Wks.

**Trucks, Electric Car.**
General Electric Co.
Westinghouse El. & Mfg. Co.

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Leffel & Co., Jas.
Replogle Governor Wks.
Smith, S. Morgan.
Stillwell-Bierce & Smith-Vaile Co.

**Universities.**
Cor. School of Technology.
Int. Corr. Schools.

**Water Wheels.**
Leffel & Co., Jas.
Replogle Governor Wks.
Smith, S. Morgan.

**Wire, Bare.**
Anderson, Albert & J. M.
Besly & Co., Chas. H.
Bishop Gutta Percha Co,
Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
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# CHICAGO EDISON CO.,

189 ADAMS ST., CHICAGO, ILL.

DEALERS IN Electric Lighting **SUPPLIES,**

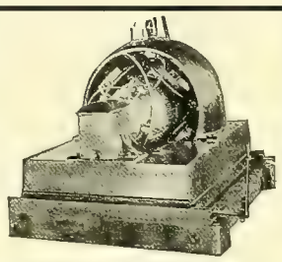
Incandescent Lamps
OF ALL CANDLE POWERS.

**NATIONAL CARBONS AND BRUSHES,**
**HARDTMUTH CORED AND SOLID CARBONS,**
**KNIFE SWITCHES, FROM 10 TO 1,000 AMPERES,** IN **STOCK.**
**CUT-OUTS, SOCKETS, ARC LAMPS AND GLOBES,**
**RUBBER COVERED WIRES, NORWICH CABLES, Etc.**


The American Circular Loom Company have opened an office at No. 1114 Marquette Building, Chicago, where they will be pleased to see their customers and friends.


**CARD** Generators for Power Transmission or Isolated Lighting.
CARD Generators are all Multipolar and Slow Speed.

AGENTS WANTED IN UNOCCUPIED TERRITORY.



75 K. W. GENERATOR.

**CARD** Multipolar Slow Speed Stationary Motors.
Reversible Motors and Controllers for Rolling Mills, Bridges and Traveling Cranes.

**THE CARD ELECTRIC COMPANY,**
Office and Works, Mansfield, Ohio.

THE PIONEER FIRM.
American Branch Office, 60 Liberty St., New York.

# F. HARDTMUTH & CO., VIENNA, AUSTRIA,

THE ONLY MANUFACTURERS OF

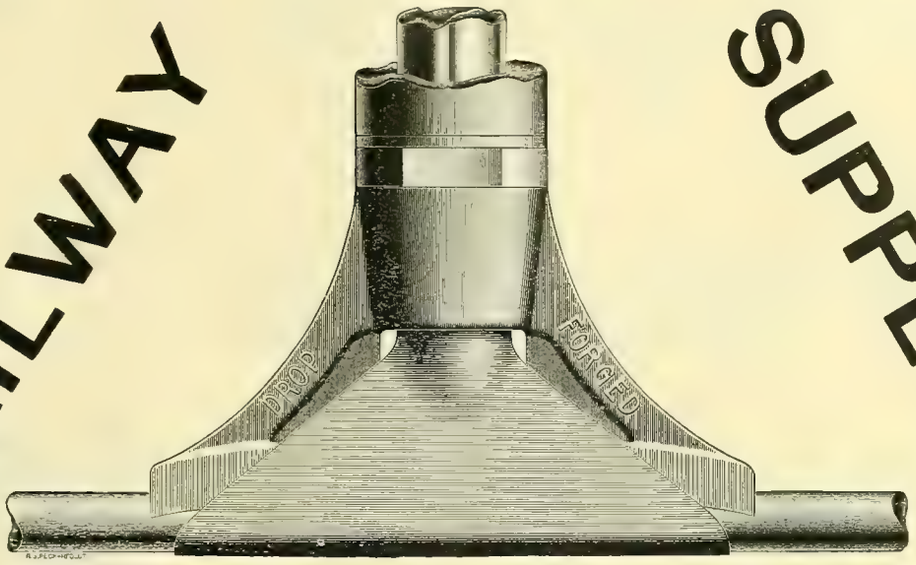
THE PIONEER FIRM.
Beware of Impostors Claiming our Make.

# "The Celebrated Austrian Cored Carbons."

Send for Reduced Price Lists or Samples.
Alternating or Direct Cored Carbons One Price.

Special Quotations for Export Trade.
Leading Supply Houses Carry our Goods.

# ELECTRIC RAILWAY SUPPLIES.




Drop Forged Mechanical Clip.

## EVERYTHING FROM THE GROUND UP—QUICK.

Western Agents for Billings & Spencer Drop Forged Material.

Rail Bonds, Construction Tools, etc.

## CENTRAL STATION SUPPLIES.

WESTERN DISTRIBUTERS FOR

Okonite Wire, Interior Conduit, Lundell Motors,
Helios Incandescent Arc Lamps.

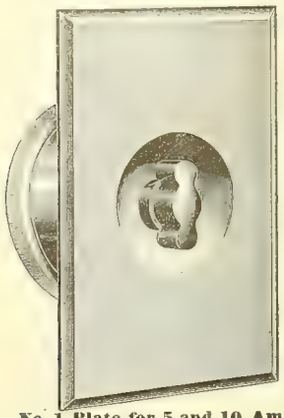
Manufacturers of the PHAROS Incandescent Lamp.

GEO. A. McKINLOCK, Prest. CHAS. E. BROWN, Secy.

**Central Electric Company,**

CHICAGO.

BRANCHES.
ST. LOUIS: Southern Electrical Supply Co.
KANSAS CITY: Gate City Electric Co.
NEW ORLEANS: 1010 Canal St.
BUFFALO: 112 White Building.



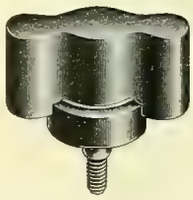
No. 1 Plate for 5 and 10 Amp. Hart Switches.

# HART FLUSH SWITCHES.

New Face Plate.

**BETTER PROPORTIONS. BETTER FINISH. MORE DURABLE.**

Made of solid plate brass $\frac{1}{8}$-inch thick, with beveled edges.



Better Design,
Better Material,

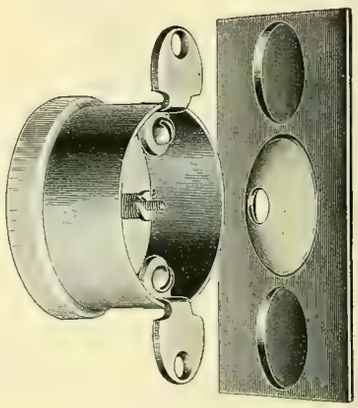
Self-Adjusting Handle,
No Breaking,

No Binding on Face Plates,
No Loose Face Plates.
Handles, Switches and Face Plates Interchangeable.

Single Plates for all sizes of Hart Switches.
Gang Plates for any number of Hart Switches.

**SEND FOR "CATALOGUE B."**

**THE HART & HEGEMAN MFG. CO., HARTFORD, CONN.**



Back of No. 1 Plate.

# THE PITTSBURGH REDUCTION CO.,

701 Ferguson Block and 121 Third Avenue,
PITTSBURGH, PA.

# ALUMINUM

## Ingots, Bars, Sheets, Plates, Wire, Tubes and Castings.

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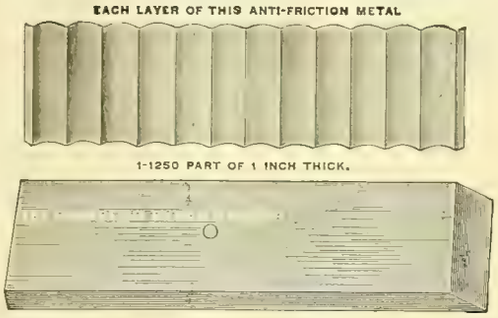
The Pittsburgh Reduction Co. have their own foundry and make a specialty of

## *ALUMINUM CASTINGS.*

# THE BOUDREAUX DYNAMO BRUSH

**IS NO EXPERIMENT.**

EACH LAYER OF THIS ANTI-FRICTION METAL




**SOME OF ITS USERS:**

Acme Storage Battery Mfg. Co., St. Louis.
Ajax Forge Co., Chicago.
Boston Bolt Co., Boston.
Buckeye Electric Co., Cleveland.
Crimmer, Craig & Co., Boston.
Cook County Criminal Court, Chicago.
Drexel Institute, Philadelphia.
Decatur Brewing Co., Decatur, Ill.
Elwell-Parker of America.
East St. Louis Packing Co., St. Louis.
Franklin Sugar Refining Co., Philadelphia.

**SOME OF ITS USERS:**

American Telegraph & Telephone Co., New York.
*Atlanta Constitution*, Atlanta.
Baldwin Locomotive Works, Philadelphia.
Bradley & Currier, New York.
Central District Printing Telegraph Co., Pittsburg.
Columbus Memorial Building, Chicago.
Dynamo-Electric Maintenance Co., Boston.
*Detroit Journal*, Detroit.
Electric Improvement Co., San Jose, Cal.
Edison Electric Illuminating Co., New York.
Feigenspan's Breweries, Newark, N. J.

## THE BOUDREAUX DYNAMO BRUSH COMPANY,

**Mallers Building, CHICAGO. Postal Telegraph Building, NEW YORK.**

SOLE AGENTS:

For the Pacific Coast, J. W. BROOKS & CO., San Francisco, Cal.
For Maryland, Virginia, Dist. of Columbia, ROBINSON ENGINEERING CO., Baltimore.
For Canada, R. E. T. PRINGLE, Montreal.
For Texas, Ind. Ter., New Mexico, Arkansas, BARDEN-SHEETS ELECTRICAL CONST'N CO., Houston, Texas.

# MACHINERY USERS!

**WHEN SUCH USERS AS—**

**Boston (Mass.) Electric Lt. Co.,**
**Woodberry Mfg. Co., Baltimore, Md.,**
**Laidlaw-Dunn-Gordon Co., Cincinnati,**
**Alden Spears, Sons & Co., Boston,**
**Cincinnati Street Railway Co.,**
**Temple Electric Co., Montreal, Canada,**
**Montmorency (P. Q.) Cotton Mfg. Co.,**
**Niagara Falls Hydraulic Power and Mfg. Co.,**
**And many others find it profitable to use**

# Tracy's Patent Oil Filter,

**Manufactured by the PHOENIX AUTOMATIC FILTER CO. Racine, Wis.,**

**WHY IS IT?**

Write us for further information. We can save you money. A few reliable agents wanted.

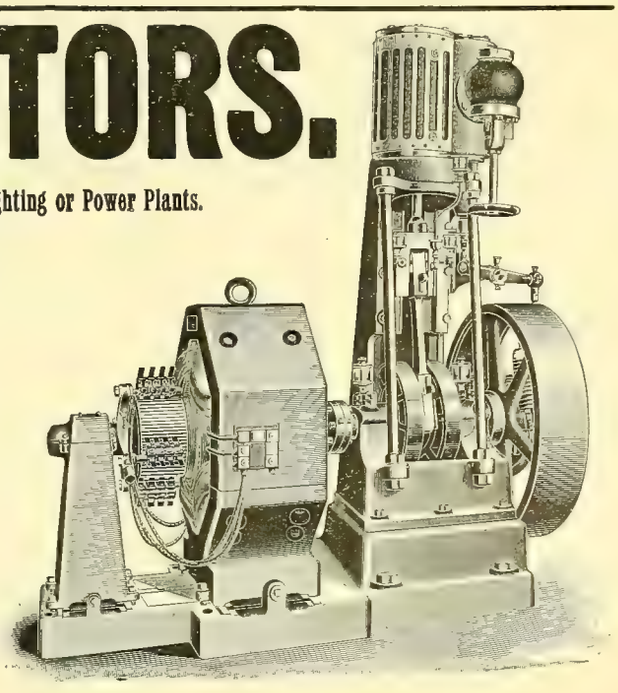
**IF** you are anxious to secure the latest electrical books, **YOU** should write to the Electrician Publishing Co., Chicago. You **CAN'T** procure too many reliable, readable books to **READ.**

# EDDY GENERATORS.

**Direct Connected or Belted for Electric Railways, Central Stations, Isolated Lighting or Power Plants.**

## EDDY MOTORS—SLOW, MEDIUM OR HIGH SPEED.

***We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.***



## THE EDDY ELECTRIC MFG. CO.,

***WINDSOR, CONN.***

NEW YORK, H. B. Coho & Co., Mail and Express Building.
PHILADELPHIA, Walter C. McIntire & Co., 506 Commerce St.
BOSTON, G. M. Angier & Co., 64 Federal St.
ELMIRA, S. N. Blake.
ST. LOUIS, Western Electrical Supply Co.
KANSAS CITY, W. T. Osborn.

# STORAGE BATTERIES.

## *ARE YOU POSTED?*

## CENTRAL STATION MEN

**DO YOU KNOW**

That a "Storage Battery Auxiliary" will help your plant over "that high point in the load line;" will insure a reserve in case of a break down; will make your entire plant more efficient; will make your service more reliable; will cut down your running time; will reduce depreciation; will lower operating expenses, and will save your coal?

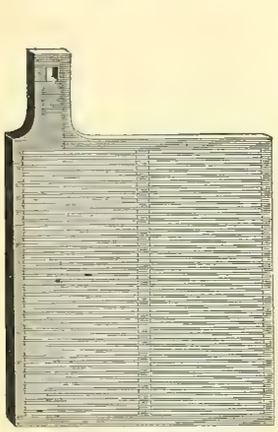
**?**

## ELECTRIC RAILWAY MANAGERS

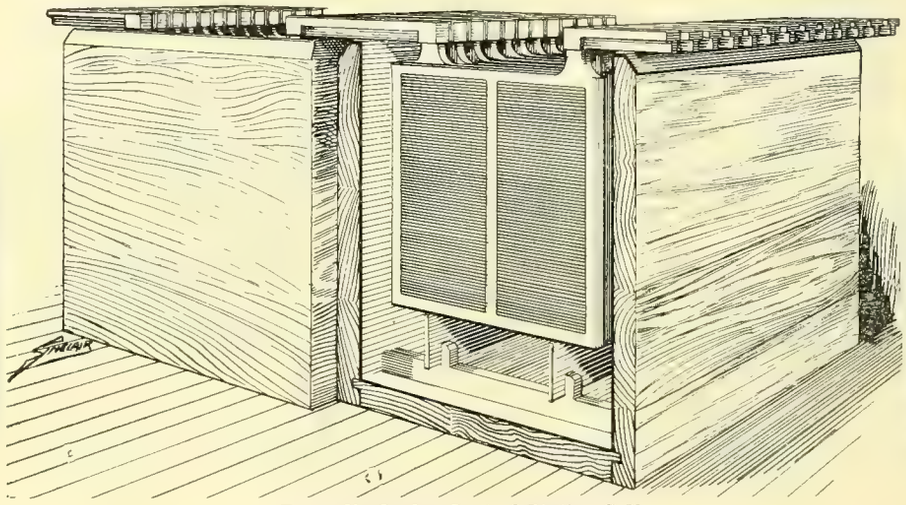
**DO YOU KNOW**

That a Storage Battery Auxiliary will effect a reduction in the first cost of plant; will convert a variable load into a steady load; will remove the danger of sudden strain on machinery; will reduce "wear and tear," and will increase the efficiency of your entire plant?

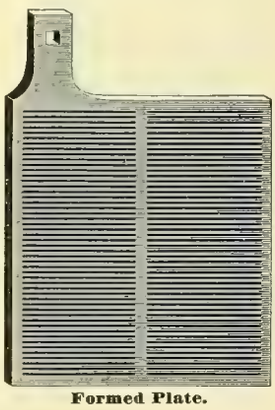
**?**



Unformed Plate.



Pumpelly-Sorley Central Station Cell.



Formed Plate.

**DO YOU KNOW**

That the **PUMPELLY SORLEY STORAGE BATTERY** is **superior to any other Battery on the Market,** because it is **stronger mechanically,** has a **higher efficiency,** and a **greater durability?**

**?**

## ELECTRICAL SUPPLY MEN

**DO YOU KNOW**

That there is a constantly increasing demand for a reliable Storage Battery from Dentists, from Physicians, for Fan Motors, for Phonographs, for Kinetoscopes, for Ventilating Fan Motors, for Sewing Machines, for Jewelers' Lathes, for Automatic Apparatus, for Laboratory Work, for Annunciators, for Gas Engines, for Telephones, for Block Signals, for Isolated Lighting Plants, for Carriage Illumination, for "Oarless Boats," Electric Launches, and "Moto-cycles?"

**?**

**"UP TO DATE"** Electrical men are posting themselves on the Storage Battery. Better write us AT ONCE for information. We like to answer questions.

# Pumpelly=Sorley Storage Battery Co.,

**Main Office: 1540 MARQUETTE BLDG., CHICAGO, ILL.**

# THE ELECTRIC STORAGE BATTERY COMPANY

## OF PHILADELPHIA, PA.,

In addition to all American Patents heretofore controlled, has recently acquired from the

**Accumulatorem-Fabrik Aktien-Gesellschaft,**

OF HAGEN (IN WESTPHALIA), PRUSSIA.

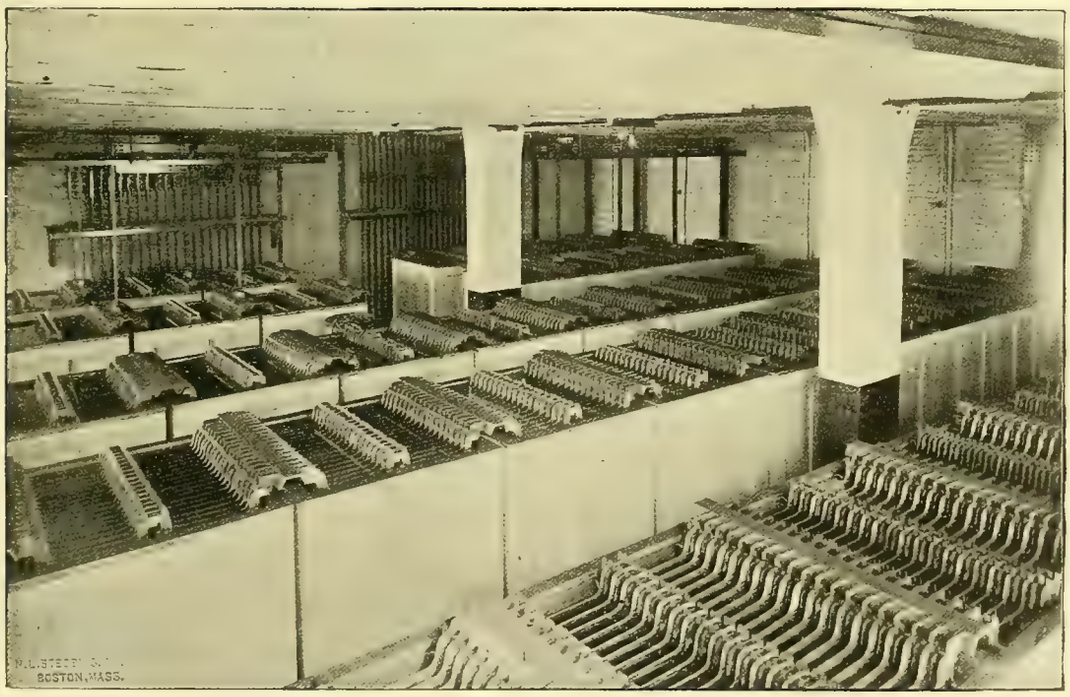
All patent rights for the exclusive manufacture of

**Tudor Storage Batteries**

in the United States, and is prepared to furnish Batteries of this type of any desired size.

**In Germany and Austria** the TUDOR BATTERY is used in eighty per cent. (80%) of all Central Stations—besides being installed in

**15 RAILWAY POWER PLANTS and 5000 ISOLATED LIGHTING PLANTS.**



TUDOR STORAGE BATTERIES—BOSTON EDISON STATION.

**Storage Batteries are Needed in Central Stations:**

**1st.** To effect reduction in first cost of plant. (Half steam power plant and half Storage Battery Plant costs only three-quarters of what all Steam Plant would cost for same work.)
**2d.** To convert variable into steady loads. This will save machinery from strain.
**3d.** To effect a saving of from 20 per cent. to 40 per cent. in coal bills.
**4th.** To insure reserve power in case of accident to generating machinery.

For particulars address,

# The Electric Storage Battery Company,

Sole Manufacturers of the "CHLORIDE ACCUMULATOR,"

**PHILADELPHIA, PENNSYLVANIA.**

# INCANDESCENT LAMPS.

WE MANUFACTURE THE "GLOBE." LIFE AND EFFICIENCY GUARANTEED.

New Process of Exhaustion by Mechanical Vacuum Pump. Absolutely Dry Vacuum. Samples and Prices Furnished on Application. Correspondence Solicited.

## GLOBE ELECTRIC LIGHT CO., 6 Clifton St., ROXBURY, MASS.

AGENTS WANTED. WRITE US.

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HIGH GRADE
## Ammeters and Voltmeters.

SEND FOR CATALOGUE.

## W. B. SOUTHGATE & CO.,

146 "B" Franklin Street, - - - BOSTON, MASS

SELLING AGENTS FOR

WHITNEY ELECTRICAL INSTRUMENTS.
TILDEN WATCHMAN'S ELECTRIC TIME RECORDER.
PEERLESS COMMUTATOR COMPOUND.
WOVEN WIRE BRUSHES.
SLATE FOR ELECTRICAL PURPOSES.

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## Gordon Primary Battery

EXCELS IN

Long Life, Efficiency,
Economy, Adaptability.
It is Absolutely Non Freezing,
Labor Saving,
Free from Local Action,
Freedom from Gases and Odors.
Superior Generation of Energy.

These Batteries are in use by the most prominent Telephone, Fire Alarm and Railroad Companies of America.
Send for descriptive circular and price list.
We guarantee all our Cells.

MANUFACTURED BY
The Gordon-Burnham Battery Co.,
82 West Broadway, New York.

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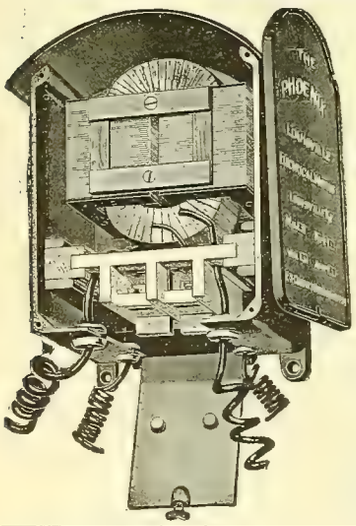

## THE PHOENIX TRANSFORMER

Is UNEQUALLED in its

High Efficiency, Close Regulation,
Small Leakage, Quiet Running.
Attractive Appearance,
Convenient Arrangement,
Separable Core, Removable Coil,
Excellent Fuse Device, and is in fact

A PERFECT TRANSFORMER.

Write for Catalogue and Prices.

MANUFACTURERS:
Louisville Electrical Works,
LOUISVILLE, KY.

SELLING AGENTS:

New York: J. A. Machado, 203 Broadway.
Philadelphia: Vallee Bros. & Co., 617 Arch St.
Denver: Russell & Officer Elect. Const. Co.
Dallas: W. T. M. Mottram.
Chicago: Chicago Gen'l Fixture Co., 169 Adams st.

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# THE UPTON ARC LAMP

For All Circuits.

**The Cheapest to Buy, Use and Maintain.**

## Standard Thermometer Co.,

PEABODY, MASS.

The Original Manufacturers of the

*SIMPLEX, WARD and KNIGHT LAMPS.*

CHARLES A. BRAMHALL, Selling Agent, 39 Cortlandt Street, NEW YORK.

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## FIVE GOOD BOOKS.

NEW DYNAMO TENDERS' HAND-BOOK.
INCANDESCENT WIRING HAND-BOOK.
BELL HANGERS' HAND-BOOK.
ELECTRIC TRANSMISSION HAND-BOOK.
TELEPHONE HAND-BOOK.

ELECTRICIAN PUBLISHING CO., 6 Lakeside Bldg., Chicago, Ill.

## ONE DOLLAR EACH.

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# BUCKEYE

INCANDESCENT LAMPS

QUALITY UNEQUALED.

FACTORY PRODUCTION TRIPLED.

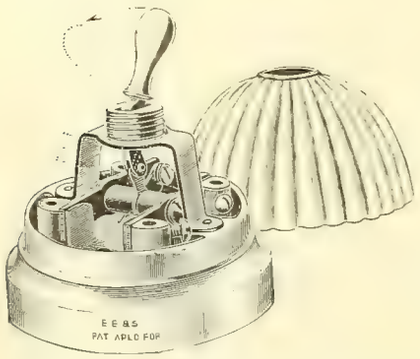
Monadnock Building, Chicago. THE BUCKEYE ELECTRIC CO., Cleveland, O.

OKONITE

TRADE MARK

**WIRES ARE THE BEST FOR AERIAL, UNDERGROUND AND SUBMARINE USE. RAILWAY FEEDER WIRES A SPECIALTY.**

# E. E. & S. CANOPY SWITCH.




This Switch is in all respects **A KNIFE SWITCH** placed **UNDER** a **COVER.** The break is quick and positive, entirely out of the control of the hand. Contacts and blades are made of pure copper. Easily wired and well proportioned.

Send us your orders and they will be promptly filled.

## Electric Engineering & Supply Co.,

**SYRACUSE, N. Y.**

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**THE DAYS ARE GROWING DARK, YOU NEED MORE LIGHT.**

## ARC LAMPS { Direct Current, Alternating, Ornamental.

**General Incandescent Arc Light Co.'s Lamps**

Can meet your desire for Style and Price.

**"SUN-SCHMELZER-NURNBERG" CARBONS.**

If you want anything in the Arc Lamp or Imported Carbon Line, write to me.

## R. B. COREY,

General Sales Agent,

**HAVEMEYER BLDG., - - NEW YORK.**

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## ELECTRICAL SUPPLIES,

## ELECTRICAL FIXTURES,

**A FULL LINE IN STOCK.**

## Chicago General Fixture Co.,

**169 ADAMS STREET,**

**CHICAGO, ILL.**

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# Hogan Water Tube Boilers

Are **supplying dry steam** to engines of 100 H. P. turning 300 to 400 revolutions, and to engines with **main pipe 238 feet** long, **without separators. No scale** forms **on heating surfaces,** and **no feed water heaters** required with the **Hogan Boilers.** Steam can be raised **in one-half hour,** instead of three hours. **Consumption of coal 20 per cent. less** than in any other boiler. **Thousands of dollars** are **saved** by the continuous evaporation of **one pound more water** per **pound of coal,** and the **Hogan Boiler evaporates two pounds more** than any other boiler **in practice.**

Send for "BOILER REVIEW." Read "TRUTH" and "PROOFS."

## HOGAN BOILER CO.,

Middletown, N. Y., U. S. A.

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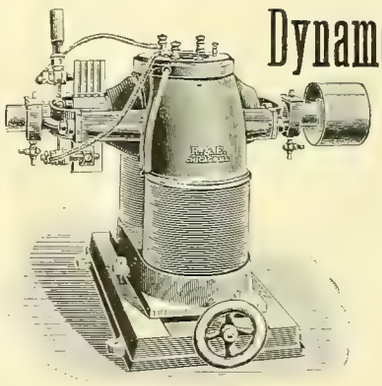

## Dynamos, Electric Motors

Manufactured by

## ROTH BROS. & CO.,

**30 to 34 Market St., Chicago, Ill.**

**DYNAMOS,**
**8 to 75 Light Capacity.**
**ELECTRIC MOTORS,**
**1-8 to 7 Horse Power.**

High Efficiency, Best Material,
Perfect Regulation, Low Prices.

**Complete Plants Installed.**

Special attention given to Dynamos and Motors for Storage Battery use.

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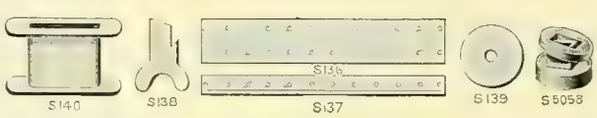
## VULCABESTON CONTROLLER PARTS.




**All Controllers are Insulated with Vulcabeston.**

***G. E. 800 and Westinghouse Commutator Rings, Brush Holder Bushings and Field Spools.***

**SEND FOR PRICE LIST.**

Moulded Mica Trolley Insulating Materials, Frogs, Crossings, Tree Insulators, Weatherproof Sockets, etc.

## H. W. JOHNS MFG. CO.,

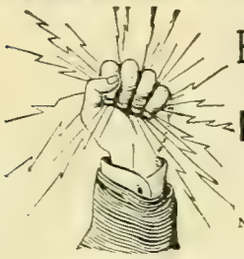
**240-242 Randolph St., Chicago, Ill.**

Gen. Elec. Co. NEW YORK. PHILADELPHIA. BOSTON. Westinghouse.

Eugene F. Phillips, Prest. W. A. Hathaway, Treas. W. H. Sawyer, Secy.

# AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.



BARE AND INSULATED ELECTRIC WIRE,
ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,
Railway Feeder and Trolley Wire,
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
CABLES FOR AERIAL AND UNDERGROUND USE.

New York Store, P. C. Ackerman, 10 Cortlandt St.
Chicago Store, F. E. Donohoe, 241 Madison St.
Montreal Branch. Eugene F. Phillips' Electrical Works.

# IRON ARMORED
# INSULATING CONDUITS.

Two Wires in a Single Tube, the Standard Method of Electric Wiring.

## INTERIOR CONDUIT & INSULATION CO.,

General Offices and Works: 527 W. 34th St., New York.

Edwd. H. Johnson, Prest. E. W. Little, Vice-Prest. and Gen. Mgr. Chas. P. Geddes, Sec'y and Treas.

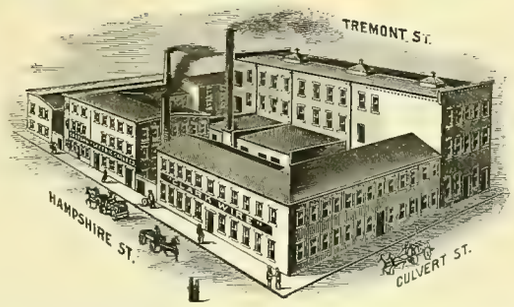
THE
# "CLARK" WIRE.

For Switchboard, Railway and Motor use, we make all sizes of Stranded and Flexible Wire and Cables with Clark's Insulation.

The Clark Wire has been before the public and in use for the past nine years, and has met with universal favor. Thousands of miles of this wire have been sold, and are in use throughout the United States and Foreign Countries, and the demand for it is constantly increasing, because it always gives perfect satisfaction.

BRANCH OFFICE:
649, 1650, 1651 MONADNOCK BLDG.,
CHICAGO, ILLINOIS.

TRADE MARK.




In a Letter from the Inspector of the Boston Fire Underwriters' Union, he states: "A Thoroughly Reliable and Desirable Wire in every respect."

The Rubber used in insulating our Wires and Cables is especially chemically prepared, and will not deteriorate, oxidize or crack, and will remain flexible in extreme cold weather, and is not affected by heat.

We guarantee our Insulation wherever used, Aerial, Underground or Submarine, and our net prices are as low, if not lower, than any other first-class Insulated Wire.

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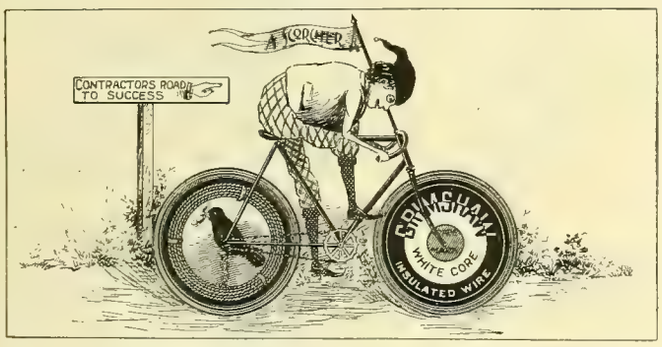


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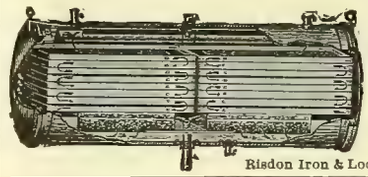

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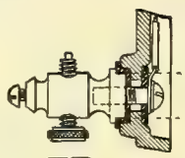

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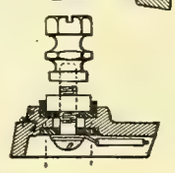

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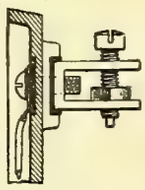

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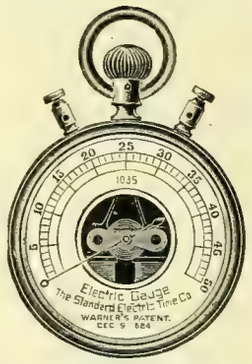


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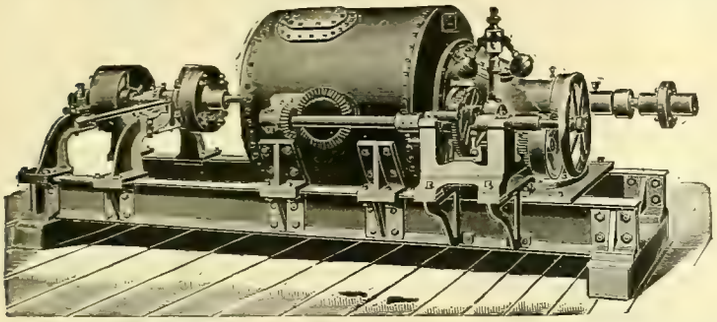

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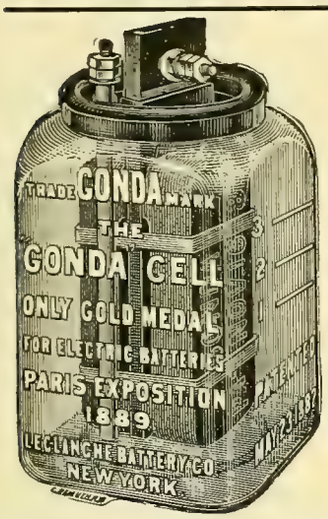


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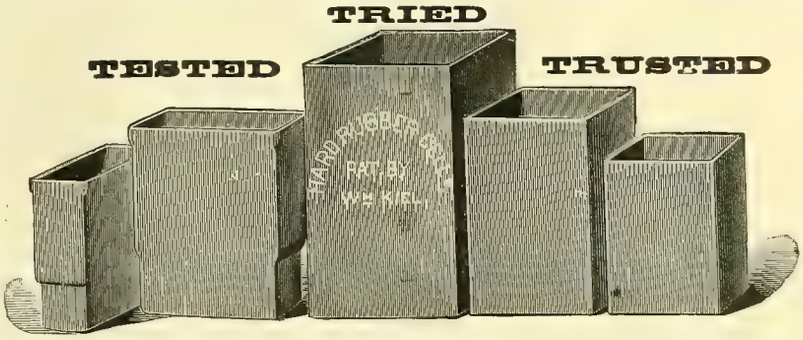


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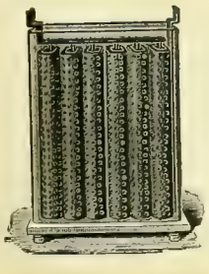

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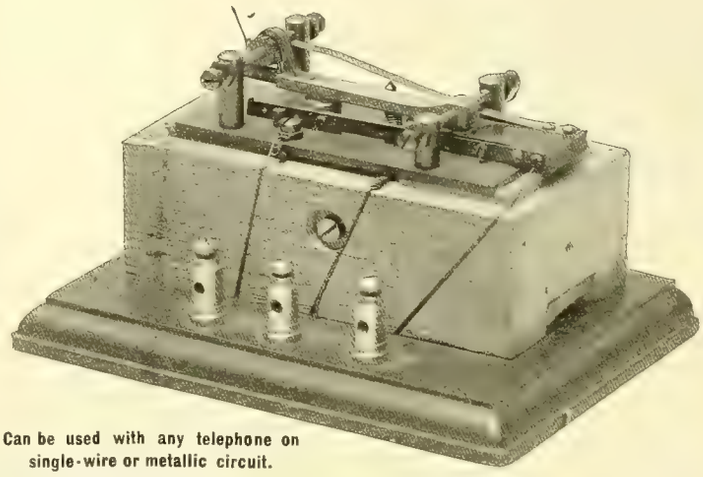

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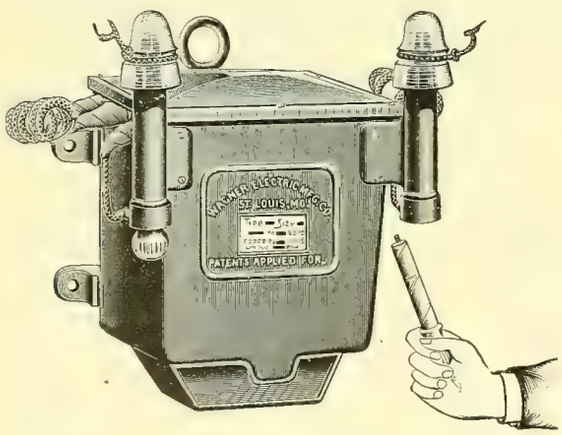


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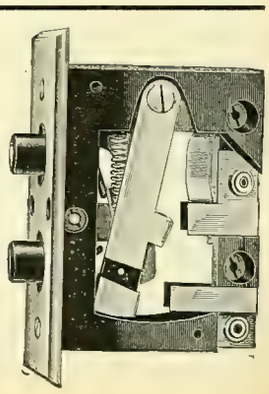

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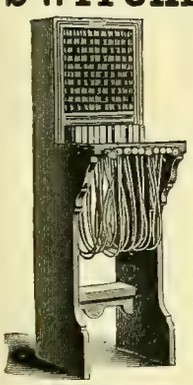

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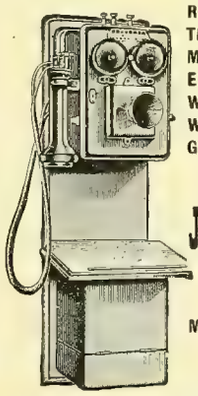

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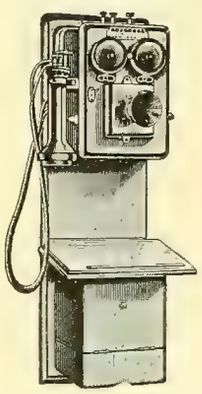

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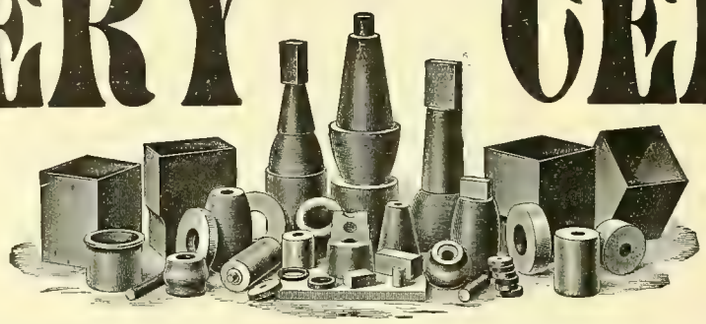

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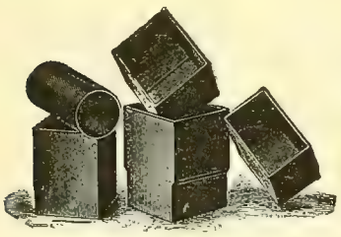

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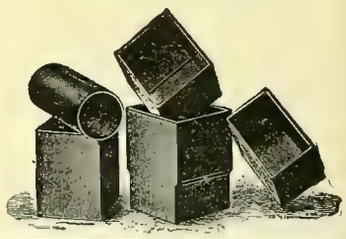

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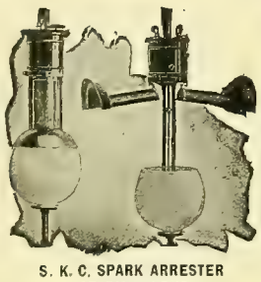

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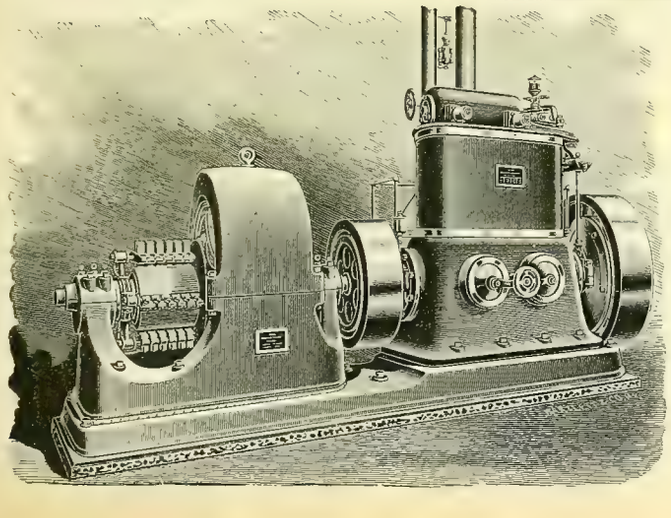

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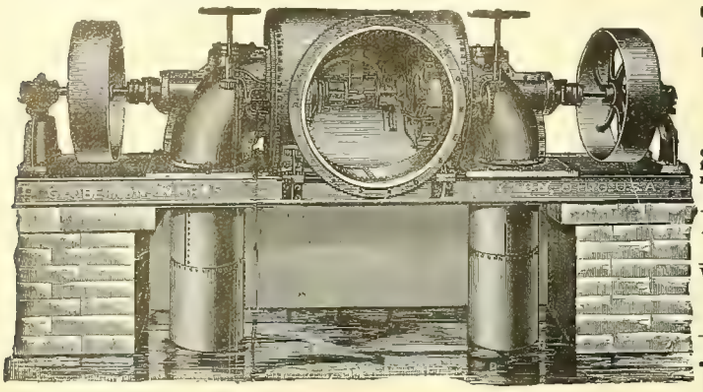

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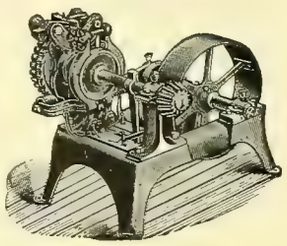

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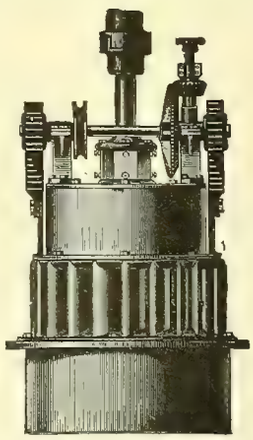

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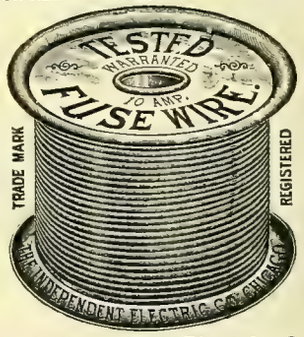


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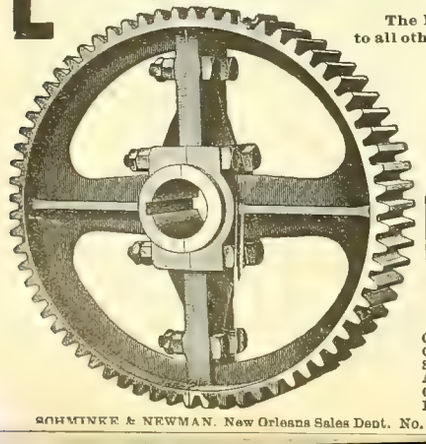

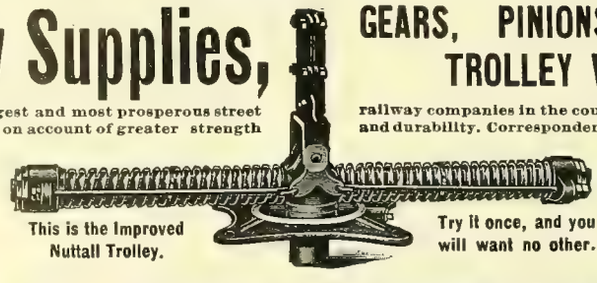

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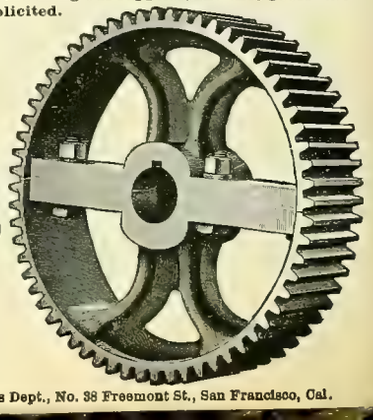

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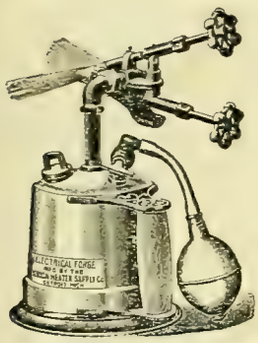

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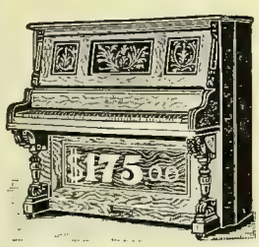

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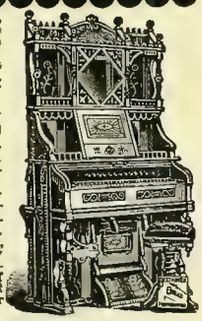

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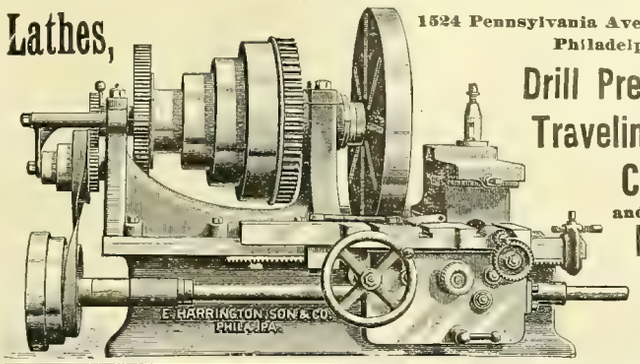


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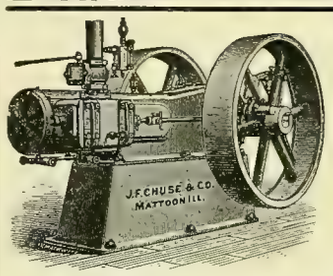


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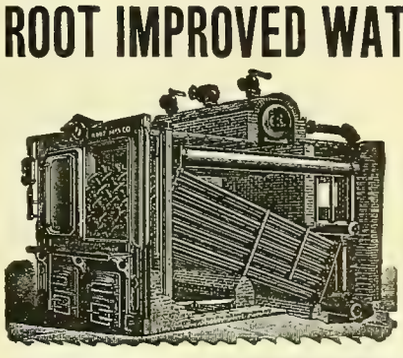

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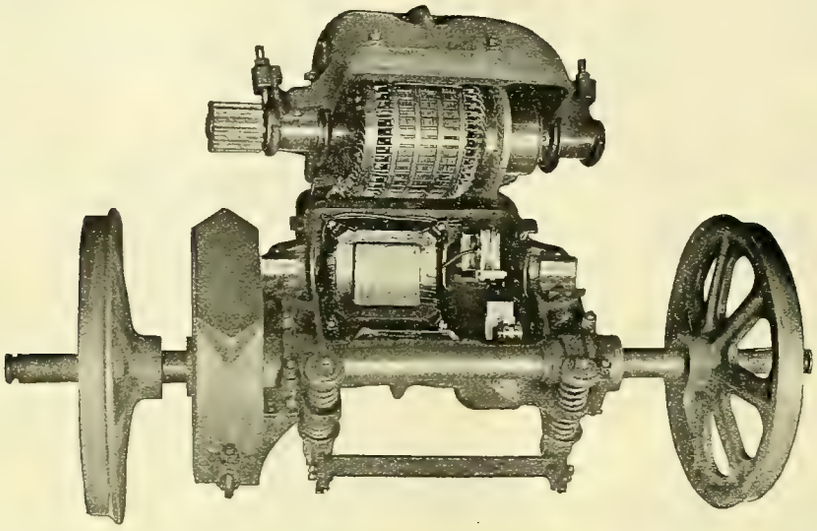

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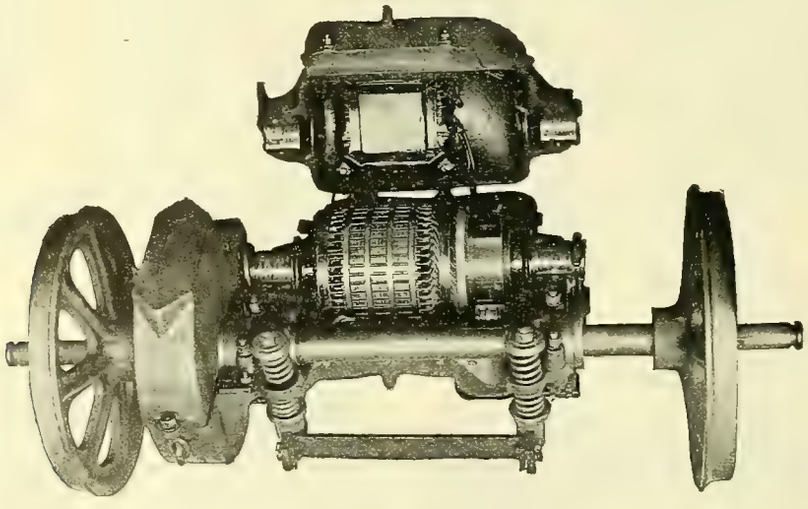

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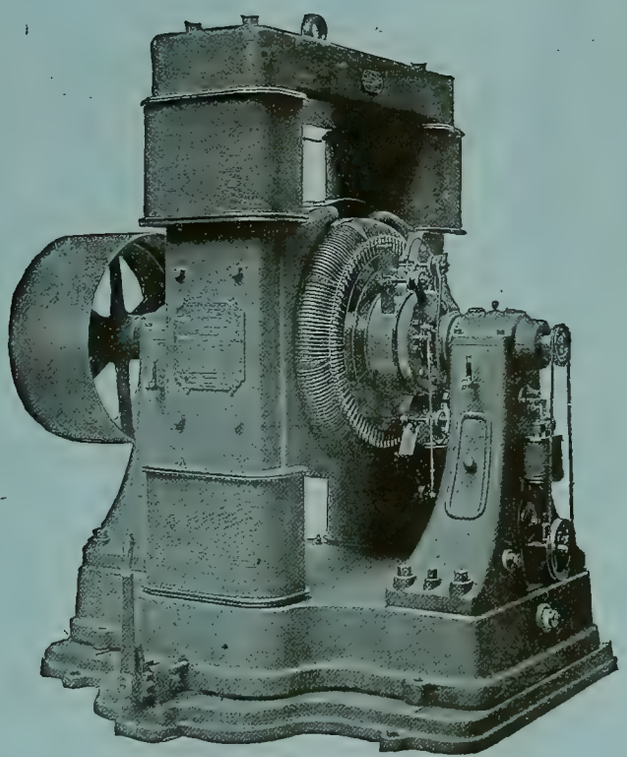

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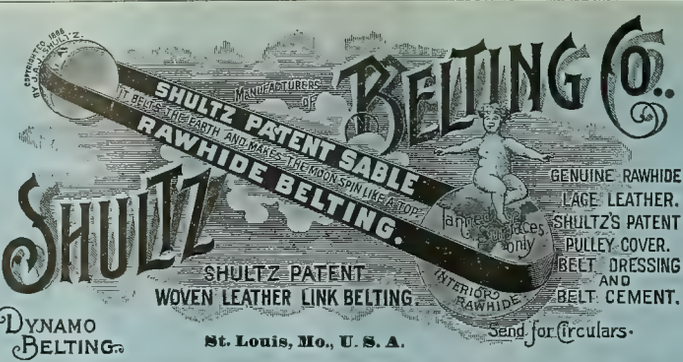


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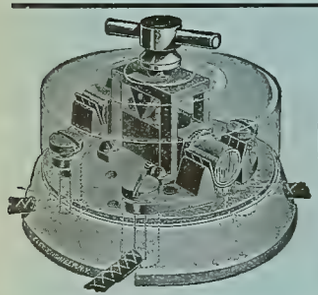

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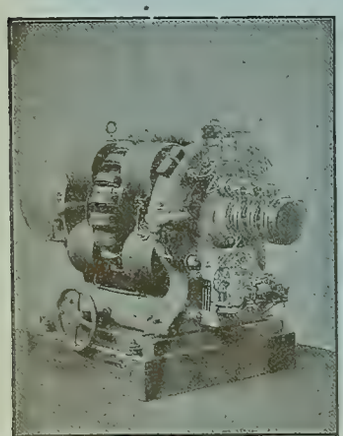

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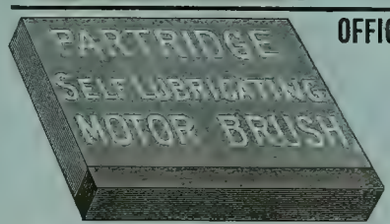


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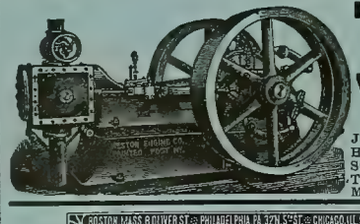

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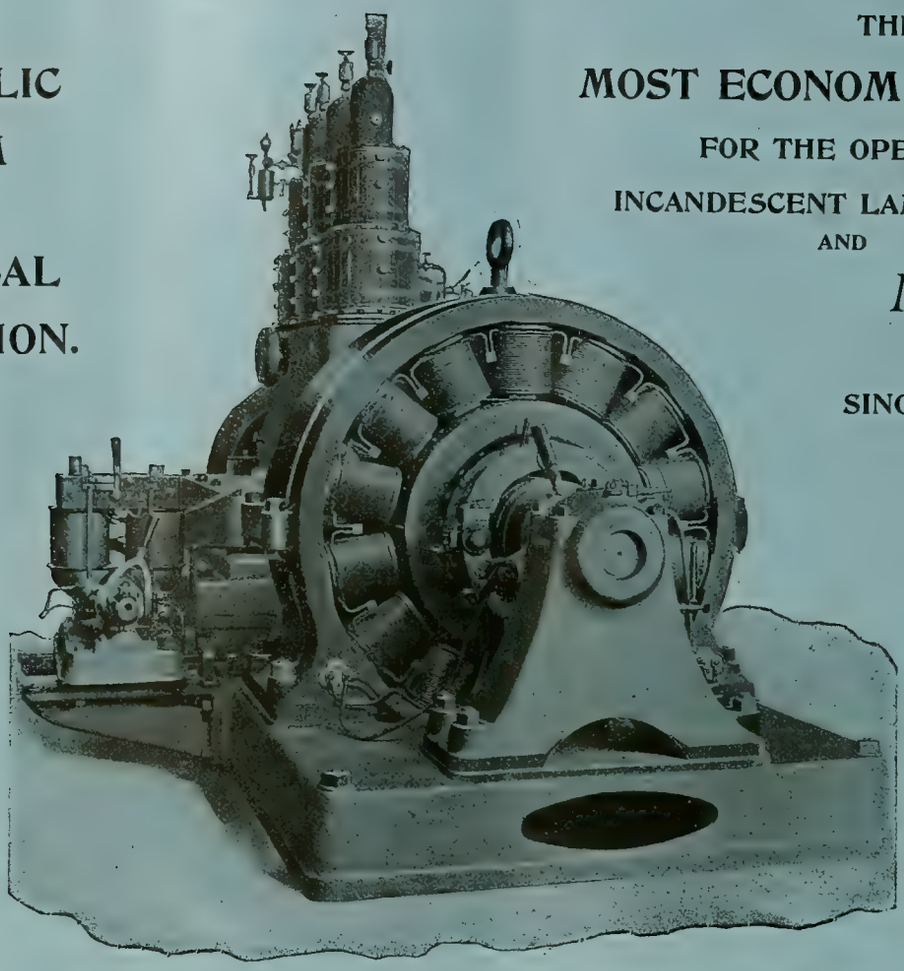

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DEALERS IN Electric Lighting **SUPPLIES,** Incandescent Lamps OF ALL CANDLE POWERS.

**NATIONAL CARBONS AND BRUSHES,**
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**For Incandescent Circuits. For Direct Current.**
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**All new lamps, all in perfect order and ready for use.**

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**High Class Foreign and Domestic.**
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It is Absolutely Non Freezing,
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Strong and Light,
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**Moulded Mica Insulation.** **Vulcabeston** Controller Parts, etc.

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CARD Generators are all Multipolar and Slow Speed.

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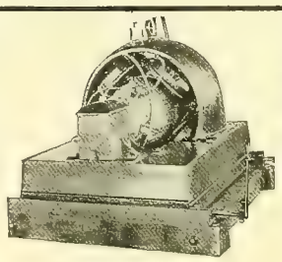

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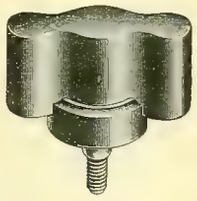

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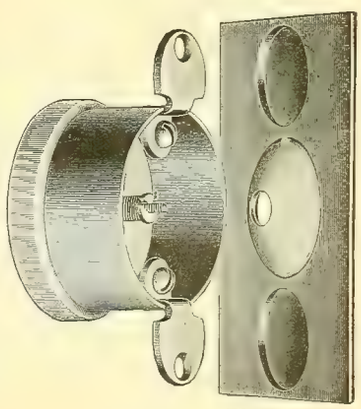

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DIRECT-CONNECTED AND BELTED.

Carbon Brushes of Ample Surface on all Machines.
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Mica Insulation. High Finish Throughout.

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# YOU NEED MORE LIGHT.

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DIRECT CURRENT,
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*CAN MEET YOUR DESIRE FOR STYLE AND PRICE.*

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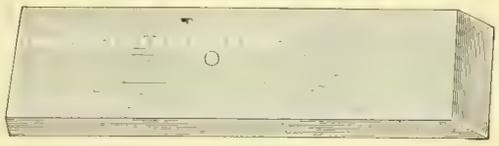
EACH LAYER OF THIS ANTI-FRICTION METAL

1-1250 PART OF 1 INCH THICK.



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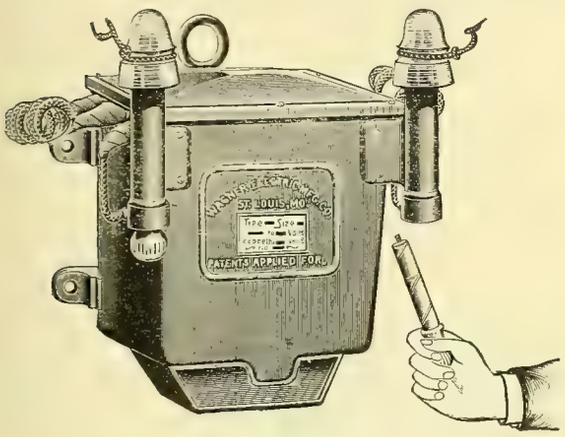


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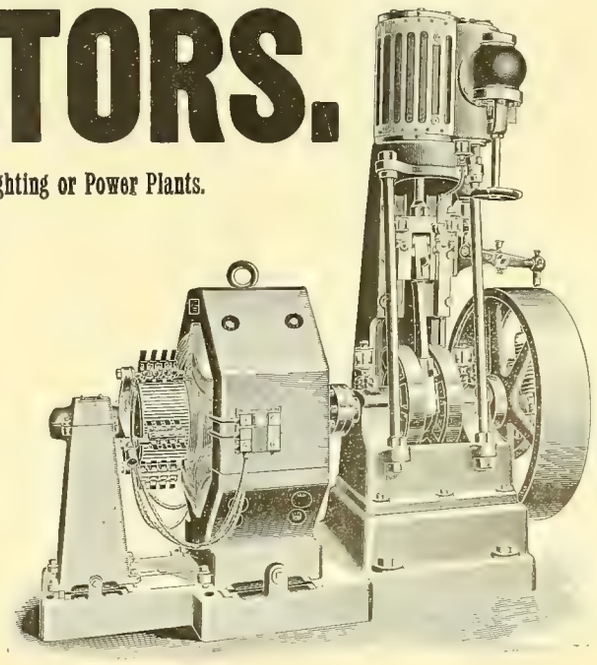

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In addition to all American Patents heretofore controlled, has recently acquired from the

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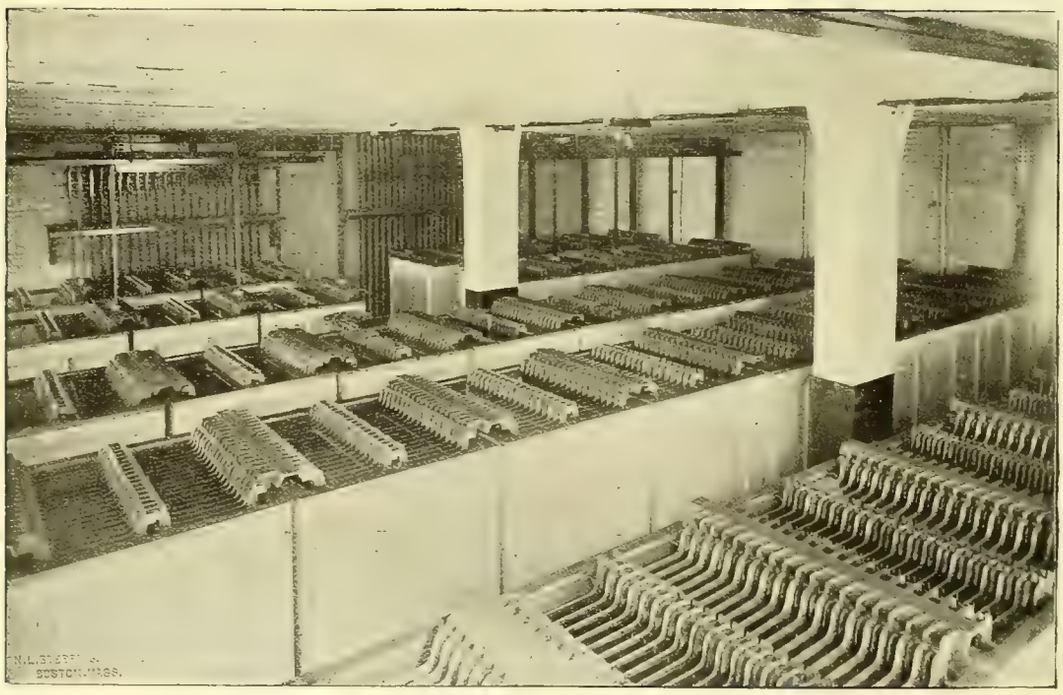
in the United States, and is prepared to furnish Batteries of this type of any desired size.

**In Germany and Austria** the TUDOR BATTERY is used in eighty per cent. (80%) of all Central Stations—besides being installed in

## 15 RAILWAY POWER PLANTS and 5000 ISOLATED LIGHTING PLANTS.



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**Storage Batteries are Needed in Central Stations:**

**1st.** To effect reduction in first cost of plant. (Half steam power plant and half Storage Battery Plant costs only three-quarters of what all Steam Plant would cost for same work.)
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Stationary Arc.

Will not see-saw.
Never take more current than they are built for.
Short circuiting absolutely impossible.
Start always with proper size Arc.

Arc Lamps for Power and Railway Circuits.

Variations in the Voltage have **no effect** on the proper working of our Lamps.

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We make our Lamps in plain and ornamental styles.

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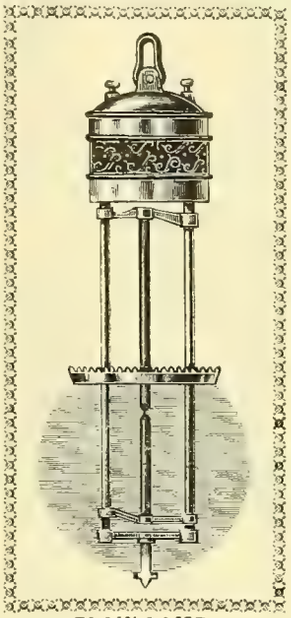

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Stationary Arc.

Perfect Insulation. Steady Light.
Our cut-out (expressly designed for these Lamps) prevents overheating of Shunt Spool.
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**Start without jumping.**
Keep always proper size Arc.
Light perfectly steady.
**No sticking possible.**
Practically noiseless.
We **guarantee** it to be **the best** Alternating Lamp ever put on the market.

**To substantiate all above claims, we will send our Lamps ON TRIAL to responsible parties. Other particulars and prices on application.**

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**The Helios Electric Company claims:**

That they have more alternating arc lamps in use than all other makes combined

They guarantee 80 per cent. more available light than is obtained from any other alternating arc lamp.

They guarantee to give as much light as any direct current lamp using the same number of watts.

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**Possesses the following advantages:**

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Can be used successfully on all periods.
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**Guaranteed not to see-saw.**

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SUCCESSORS TO

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New Process of Exhaustion by Mechanical Vacuum Pump. Absolutely Dry Vacuum. Samples and Prices Furnished on Application. Correspondence Solicited.

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WITHOUT BACK PRESSURE,

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# Packard Mogul Lamp.

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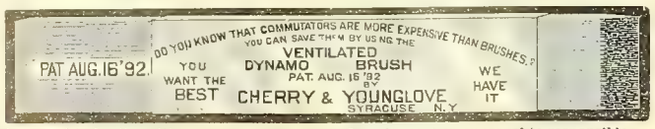
ELECTRICAL SUPPLIES. 242 MADISON ST., CHICAGO.

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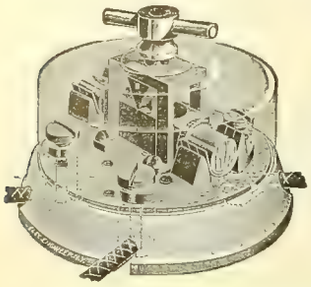

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HAVE COME AND GONE, BUT THE

## NEW ENGLAND SWITCH

IS STILL THE

## PEER OF ALL.

TRY THEM AND WONDER WHY YOU EVER USED ANY OTHER.

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We also manufacture Oak Pins and Brackets, and GENUINE BLACK LOCUST PINS.

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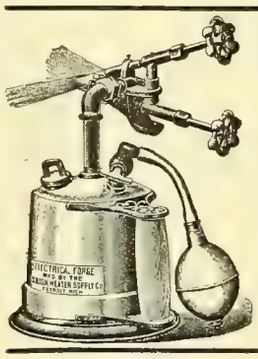


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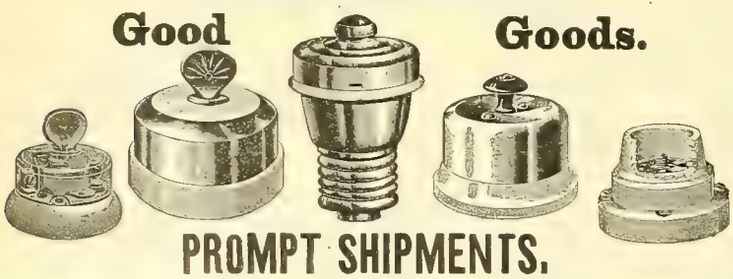

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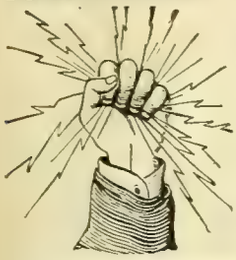

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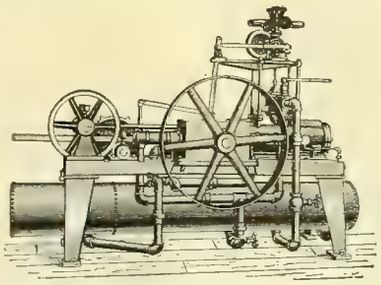

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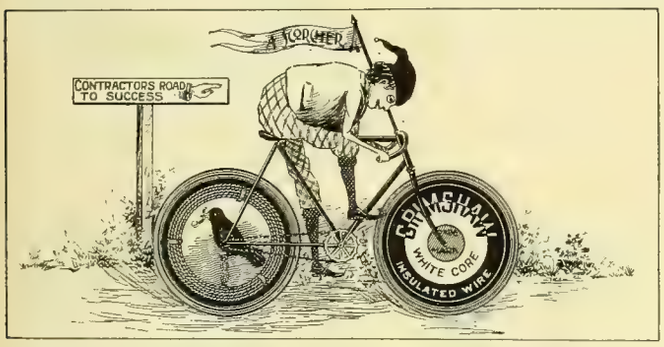


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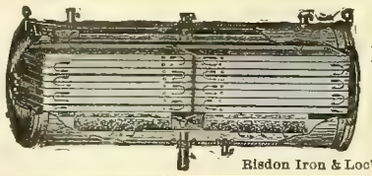

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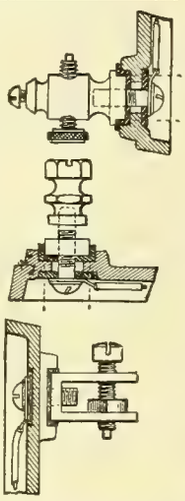

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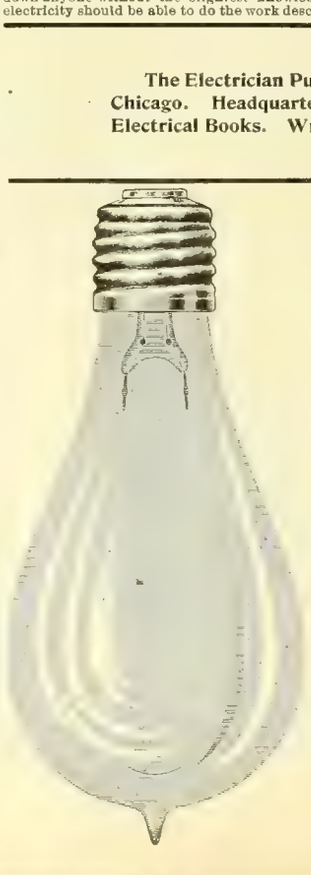

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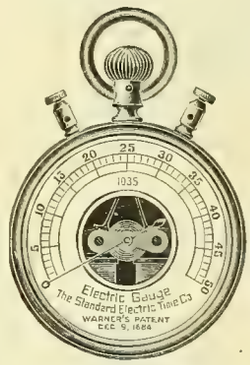


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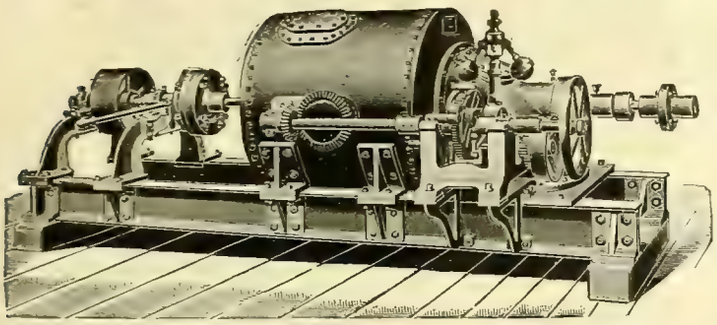

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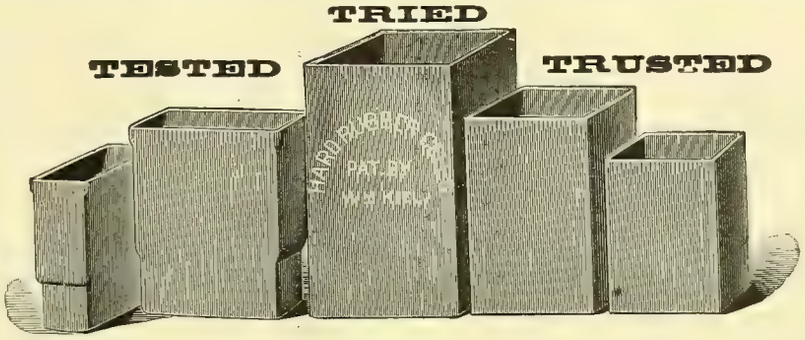


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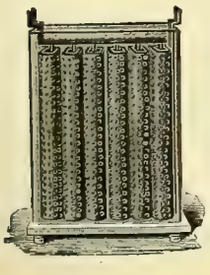

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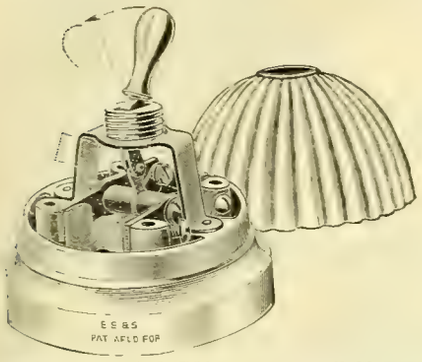


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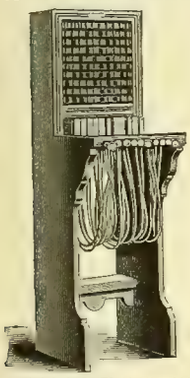

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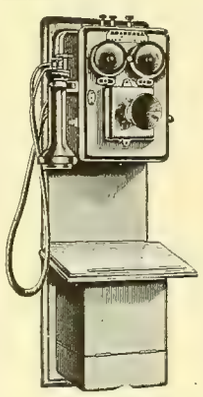

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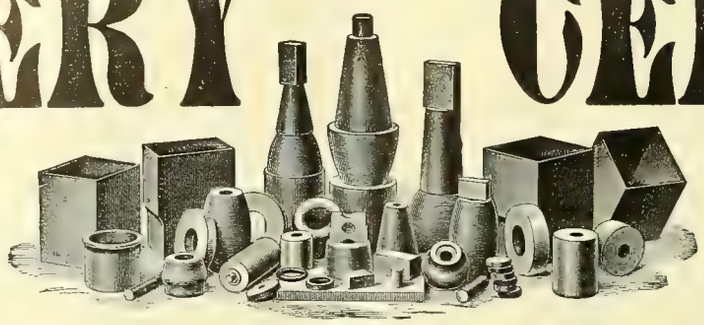

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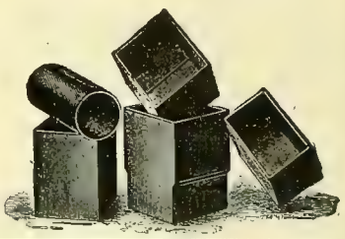

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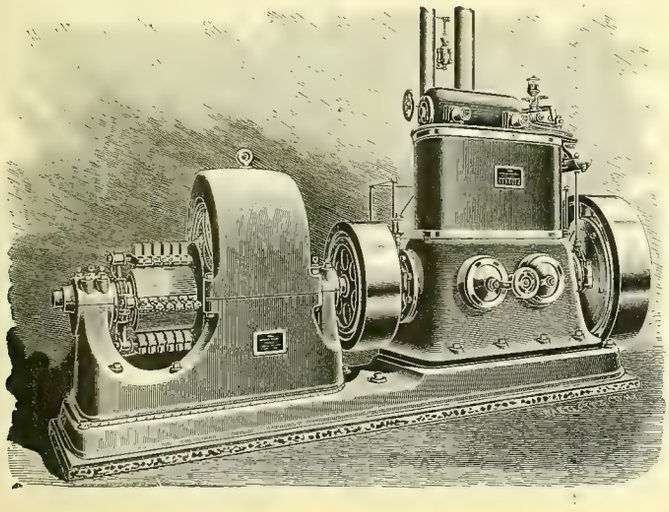

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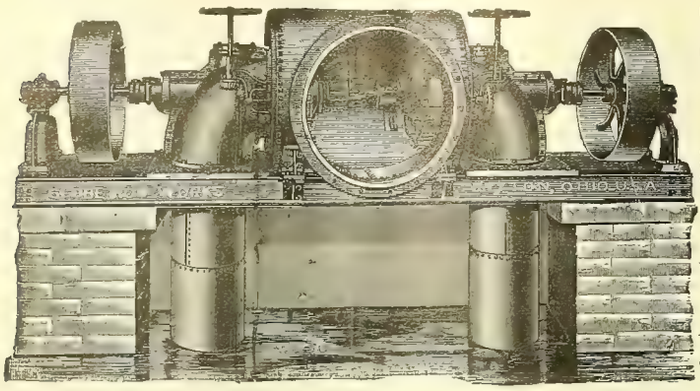

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**Test of a 45-inch Wheel—July 9, 1894.**

| | Head. | Rev. per Min. | Cu. Ft. per Sec. | Horse Power. | P'r Cent |
|---|---|---|---|---|---|
| Whole Gate | 16.06 | 119.17 | 141.58 | 205.27 | 79 76 |
| ⅞ " | 16.42 | 122.00 | 127.18 | 195.19 | 82.58 |
| ¾ " | 16.78 | 117.33 | 112.60 | 175.74 | 82.18 |
| ⅝ " | 17.03 | 111.83 | 98.12 | 149.99 | 79.31 |
| ½ " | 16.88 | 118.67 | 82.07 | 118.40 | 75.52 |

**Test of a 42-inch Wheel—July 14, 1894.**

| | Head. | Rev. per Min. | Cu. Ft. per Sec. | Horse Power. | P'r Cent |
|---|---|---|---|---|---|
| Whole Gate | 16.33 | 128.00 | 134.18 | 199.56 | 80.50 |
| ⅞ " | 16.66 | 134.80 | 120.85 | 188.14 | 83.09 |
| ¾ " | 16.59 | 129.33 | 104.85 | 162.89 | 82.77 |
| ⅝ " | 17.13 | 125.25 | 92 76 | 142.40 | 79 21 |
| ½ " | 17.48 | 121.00 | 70.80 | 98.85 | 70.60 |

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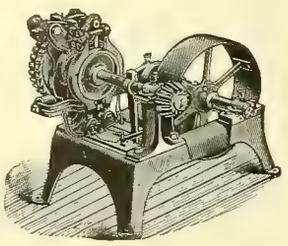

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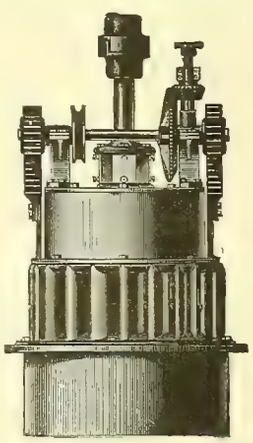

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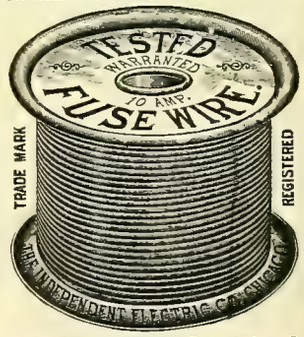


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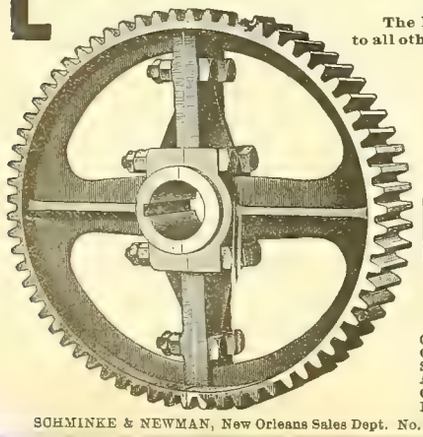

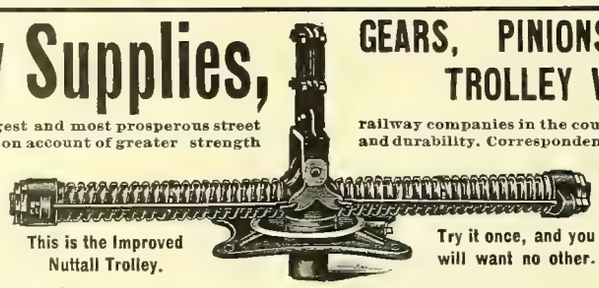

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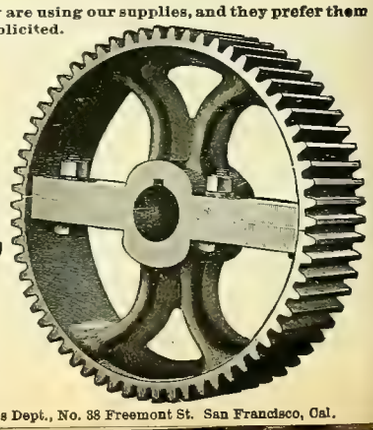

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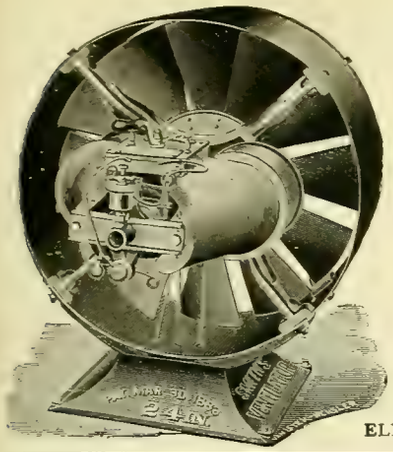

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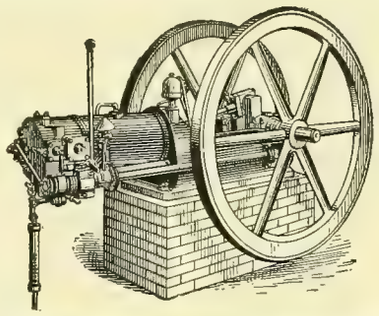

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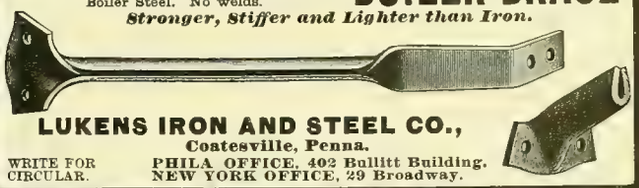

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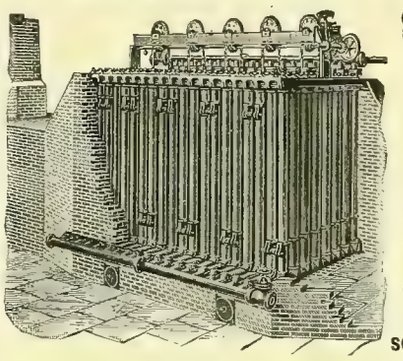

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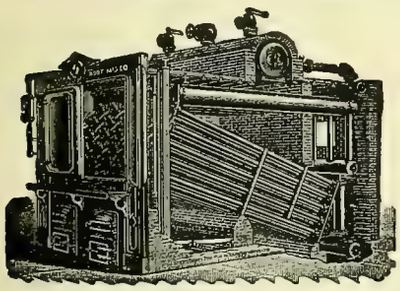

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|---|---|---|---|---|---|---|---|---|---|
| | C. P. | Current. | C. P. | Current. | C. P. | Current. | C. P. | Current. | |
| 21 | 18.0 | 10 | 18.0 | 10 | 15.8 | 10 | 13.2 | 9 | 600 |
| 22 | 16.5 | Lamps. | 17.0 | Lamps. | 14.3 | Lamps. | 8.0 | Lamps. | |
| 23 | 18.6 | 9.99 | 17.5 | 9.97 | 15.2 | 9.99 | 12 4 | 8.83 | |
| 24 | 15.5 | Amperes | 15.2 | Amperes | 13.6 | Amperes | 13.0 | Amperes | |
| 25 | 18.0 | Watts | 18.0 | Watts | 18.3 | Watts | 13 0 | Watts | |
| 26 | 17.5 | per C. P. | 17.5 | per C. P. | 16.0 | per C. P. | 14.4 | per C. P. | |
| 27 | 17.1 | 2.97 | 17.0 | 2.9 | 14.8 | 3.2 | 13.0 | 3.8 | |
| 28 | 15.2 | | 15.8 | | 14.6 | | 12 2 | | |
| 29 | 15.2 | | 15.1 | | 14 3 | | 11.5 | | |
| 30 | 16.2 | | 15.5 | | 14.7 | | 13 5 | | |
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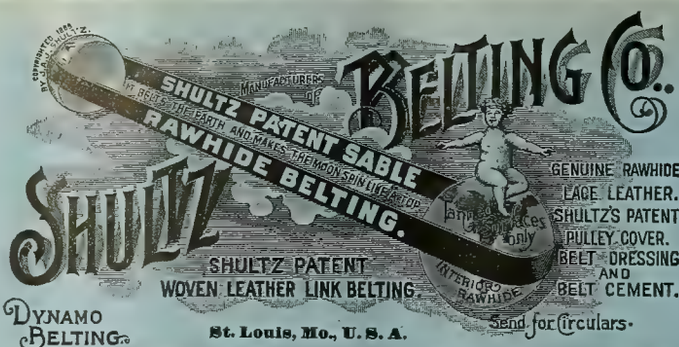


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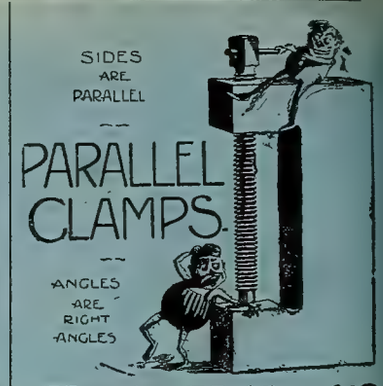


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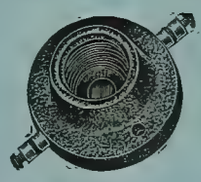

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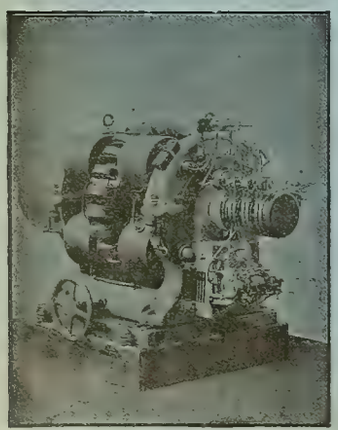

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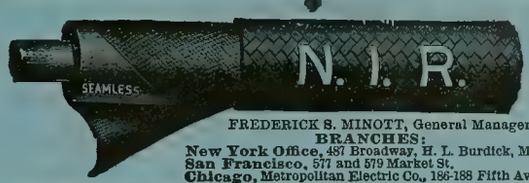


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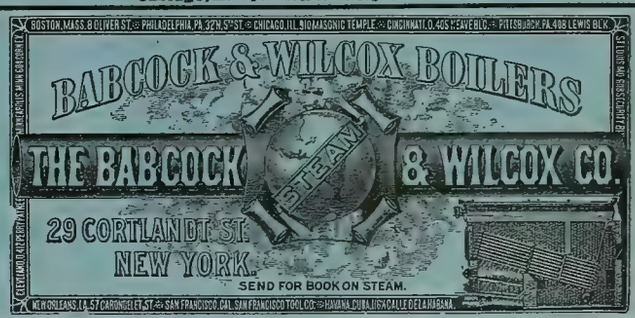


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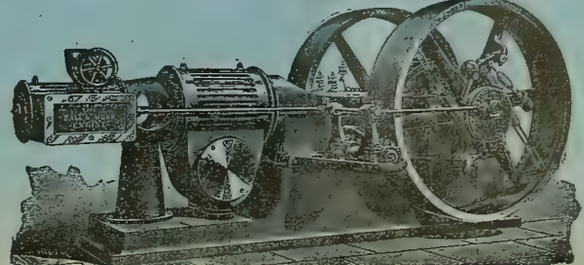

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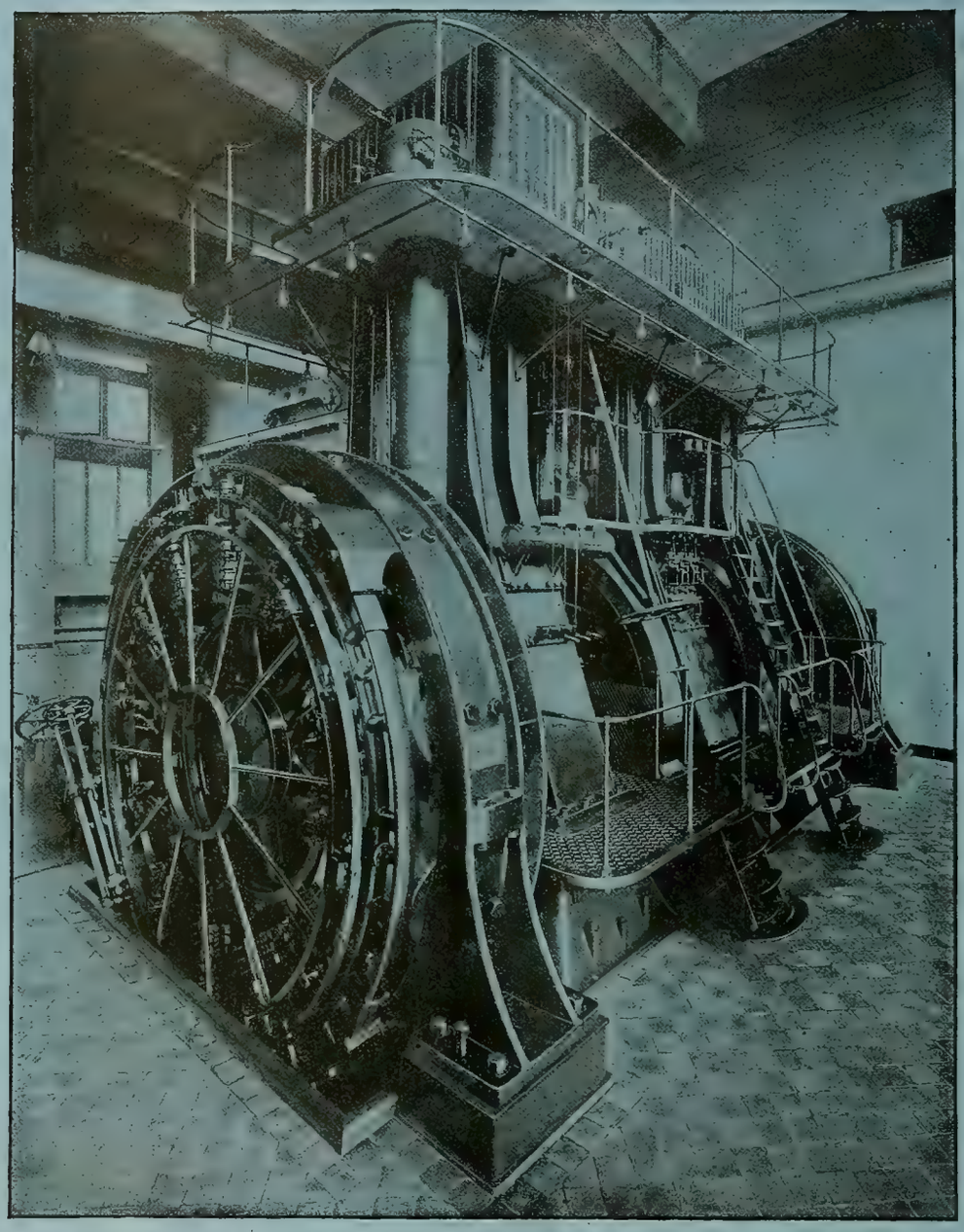

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Hart & Hegeman Mfg. Co.
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Central Electric Co.
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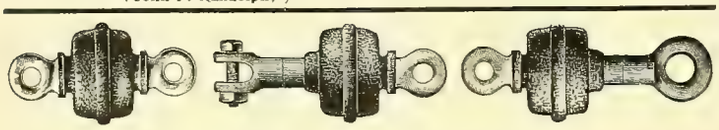

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Generators for Power Transmission or Isolated Lighting.
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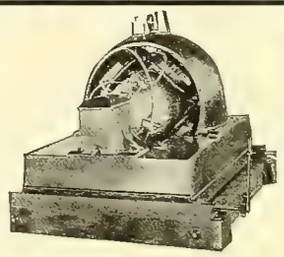

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Alternating or Direct Cored Carbons One Price.

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We are the General Western Agents for the Billings & Spencer Drop Forged

## Trolley Equipments and Commutator Segments.

We can supply Segments from stock to fit all standard machines. These Segments are made from pure lake copper, finished and tempered to give a compact, uniform wearing surface.

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We carry a large stock of Drop-Forged Straight-Line Hangers, Single and Double Curve Pull-Offs, Bracket-Arm Insulators, Barn and Bridge Hangers, Feed Wire Hangers, Trolley Wire Clamps, etc.

## Central Trolley Harp and Wheel.

This harp is made of malleable iron or brass, and is strong and well designed. The wheels are of bronze and have the best grade of graphite bushings. The entire construction is such that it cannot engage with, and tear down, span wires. We recommend the Central Harp and Wheel to our customers as being a superior article in every way.

Prompt shipment of all goods from Chicago stock.

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**Southern Electrical Supply Co.**

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**Kansas City,**
**Gate City Electric Co.**

**Buffalo: 112 White Building.**


## Chicago Tales.

THE REAR platform of the cable car stood a rather short and florid man with his coat collar turned up.

He did not say anything until the conductor gave a signal to go ahead, just as a woman put her hand on the rail. The woman had to jump to avoid being left.

"You're a little too quick with the bell," remarked the passenger who had his collar turned up.

"I am, am I?" asked the conductor, turning about and glaring at the short man. "Who's running this car?"

"You are to-night. I don't know who'll be running it to-morrow."

"Well, I know my business, and I don't want any lip from anybody, see?"

"You probably never stopped to consider the extent of your authority," said the short man softly. "It seems to me that a passenger has a right to call attention to the fact that you are too quick with the bell."

"Humph! What are you going to do about it? Take my number?"

"Yes, I thought I would."

"Well, there it is; can you see it? Take the number on my cap and the number of the car."

"All right, I've got them. I think this is the last trip you'll make on this car to-night."

"Say, I meet fellows like you every day. You're talking through your hat."

"That'll be all right. Let me off at the next corner."

The short and soft-spoken man alighted, followed by the defiant grin of the conductor.

When that car reached the limits station the superintendent of the place was waiting for the conductor.

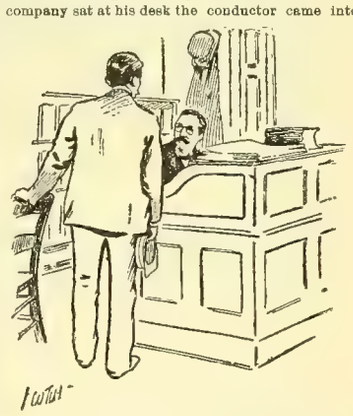
"I've put another man on your car," said he. "You're laid off."

"Laid off? What for?"

"You can find out later. I just received a telephone message from the general solicitor to be sure and have some one else take your car out on the next trip. Don't you know what's the trouble?"

"Why, no. I haven't seen—hold on! That must have been him on the back platform."

Next morning as the general solicitor of the company sat at his desk the conductor came into



CAME TO SQUARE HIMSELF.

the room and humbly waited for a chance to "square himself."

He was contrite and worried, but he made a mistake in his effort to explain matters.

"I'm mighty sorry," said he, "but I didn't know you was an officer of the company."

"Stop right there! What difference should that have made? I didn't speak to you as an officer of the company. I simply said to you that you were too quick with the bell. You didn't give that woman time to get on the car. Then you turned on me as if it were a presumption for any passenger to offer suggestions. I have no doubt you are a faithful employe. Your record shows that you are all right, but I want to impress on you that passengers have rights that conductors must respect."

In a couple of days the conductor was reinstated, but the story of his experience must have been passed around. One evening the attorney for the company was returning home on a crowded car with an earnest gripman on the front.

Every time the car started it made a sudden lunge and nearly upset everyone. The attorney motioned to the conductor and said: "I wish you'd tell that gripman to be a little easier in catching the cable."

The conductor said "Certainly" and went forward. After that the passenger had a smooth voyage. —*Chicago Record.*

## Loaded Down with Coppers.

In Detroit:

"I see they're getting a very athletic lot of men now as street-car conductors."

"Yes; they have to."

"Why is that?"

"Three-cent car fare, you know!"

# INCANDESCENT LAMPS.

WE MANUFACTURE THE "GLOBE." LIFE AND EFFICIENCY GUARANTEED.

New Process of Exhaustion by Mechanical Vacuum Pump. Absolutely Dry Vacuum. Samples and Prices Furnished on Application. Correspondence Solicited.

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New Discounts on Standard Series Incandescent Lamps For all Systems and for any Current, Candle-Power or Base.

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**Improved Long Distance Series Incandescent Apparatus and Supplies.**

CORRESPONDENCE SOLICITED. SATISFACTION GUARANTEED

THE DAYS ARE GROWING DARK, YOU NEED MORE LIGHT.

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Direct Current, Alternating, Ornamental.

General Incandescent Arc Light Co.'s Lamps

Can meet your desire for Style and Price.

"SUN-SCHMELZER-NURNBERG" CARBONS.

If you want anything in the Arc Lamp or Imported Carbon Line, write to me.

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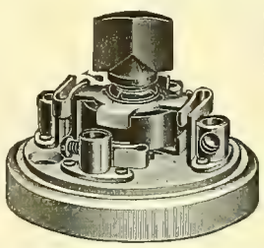
STANDARD SWITCHES, 5 and 10 ampere S. P.
10 amp. 3 and 4-way, 10, 15, 30 and 50 amp. D. P.



## FLUSH SWITCHES

Of any of the above sizes, either on single plates or with any number of switches upon one plate.

*Cut illustrates 4-way or commutation switch, controls a light or group of lights from any desired number of points.*

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# THE TELEPHONE HAND-BOOK

BY HERBERT LAWS WEBB.

*Member of the American Institute of Electrical Engineers, and of the Institution of Electrical Engineers, London. Author of "A Practical Guide to the Testing of Insulated Wires and Cables." Joint Author of "Electricity in Daily Life."*

146 Pages, 138 Illustrations, Cloth, Hand-Book Size, Price $1.00.

EXTRACT FROM PREFACE.

"This little book has no pretension to be considered a complete treatise on telephony as it exists in America. The time for such a work is not yet come. But it is felt that there is a demand for a practical book on telephone working and management, and THE TELEPHONE HAND BOOK is an attempt at meeting that demand. With the exception of a few chapters dealing with certain forms of transmitters and receivers used in Europe, which are given for the information of those who may wish to engage in the manufacture of telephones, the book is based entirely on standard American practice; and most of the material, apparatus and methods described are peculiar to or have originated in this country."

No pains have been spared to make it the best book of its kind. It is right up to date, intensely practical, and so plain and clear in its language that any one can understand and learn from it everything regarding telephone work and management. It conforms in size and style to our other Hand-Books which have been so favorably received by the entire electrical fraternity.

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2. Sound Waves. Articulate Speech.
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36. Exchange Working.
37. Small Exchanges.
38. Party Lines: The Bridging Bell.
39. Long Distance Telephony.
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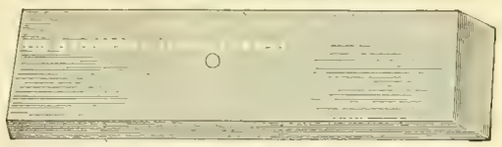

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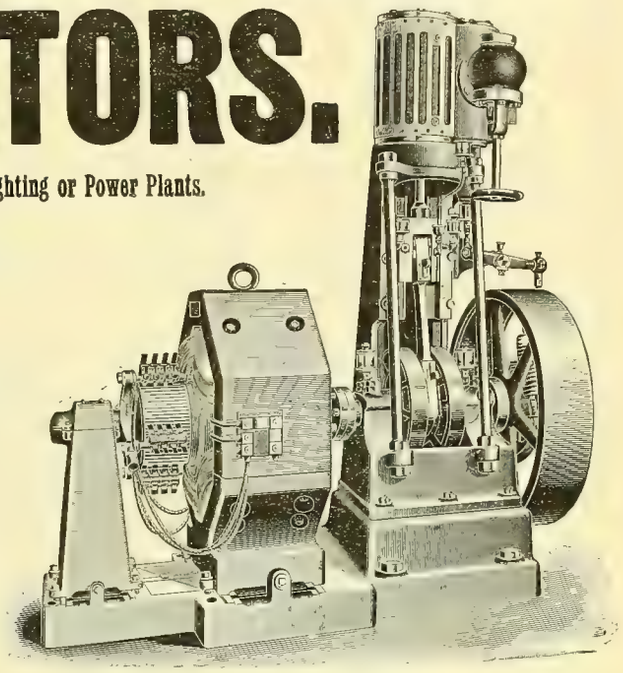

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*We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.*

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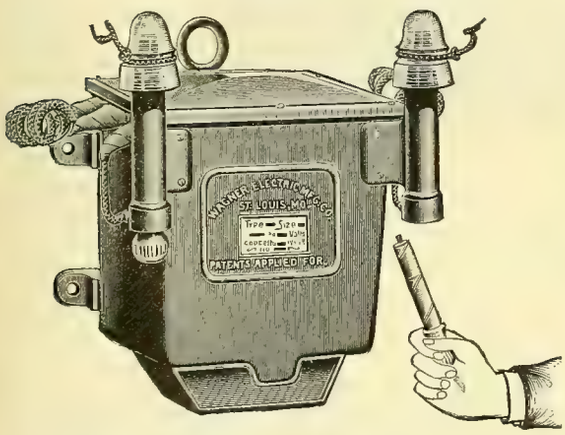


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**Transformers for all purposes.**
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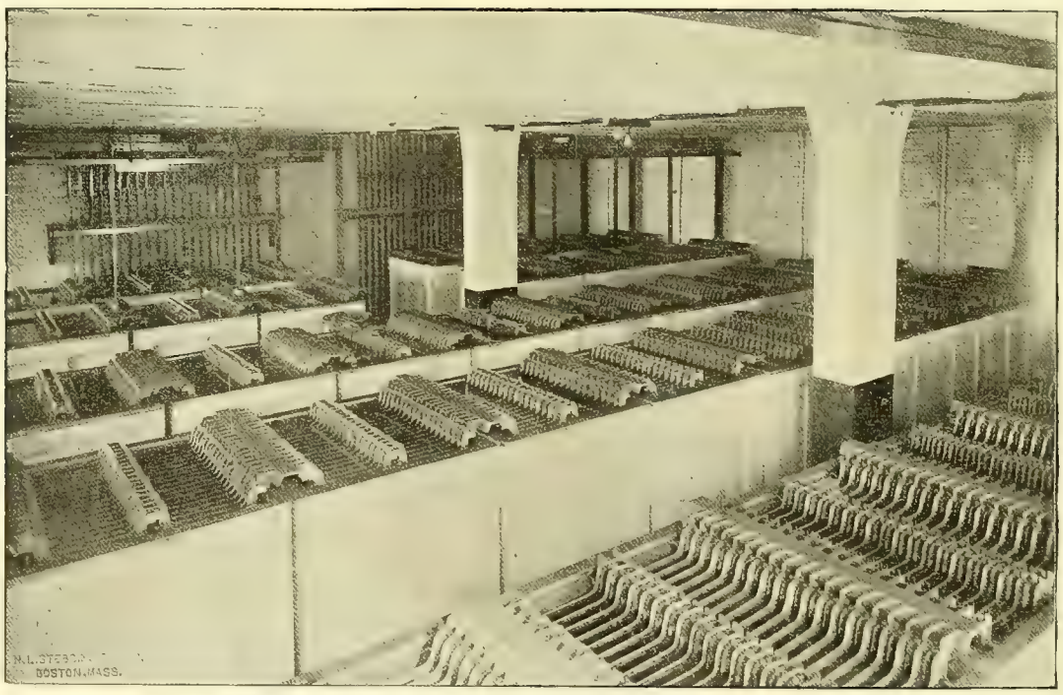

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### DIRECT CURRENT LAMPS
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Stationary Arc.

**Will not see-saw.**
Never take more current than they are built for.
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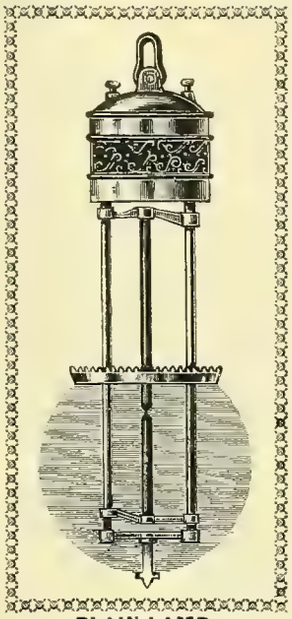

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Perfect Insulation. Steady Light.
Our **cut-out** (expressly designed for these Lamps) **prevents overheating** of Shunt Spool.
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**Start without jumping.**
Keep always proper size Arc.
Light perfectly steady.
**No sticking possible.**
Practically **noiseless.**
We **guarantee** it to be **the best** Alternating Lamp ever put on the market.

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We will give

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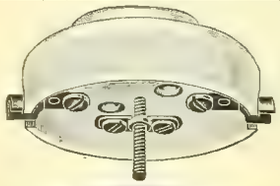

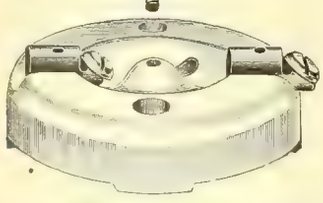

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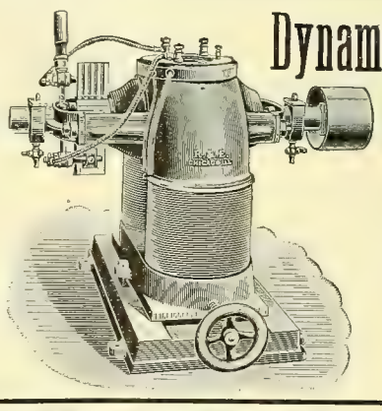

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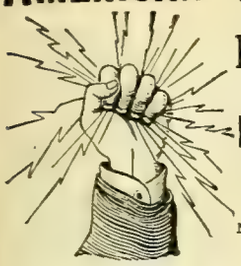

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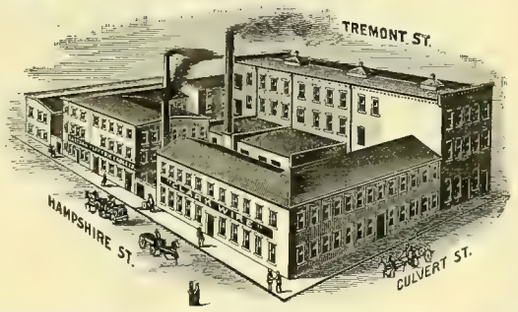


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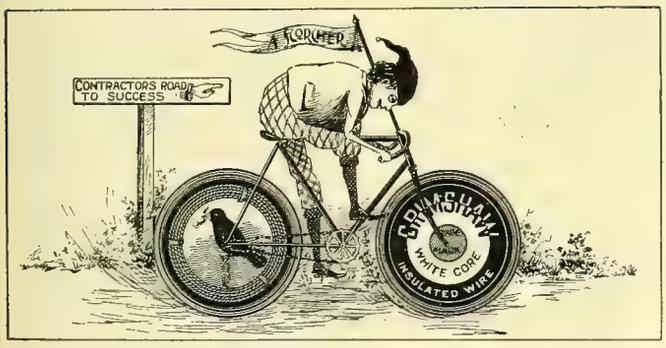


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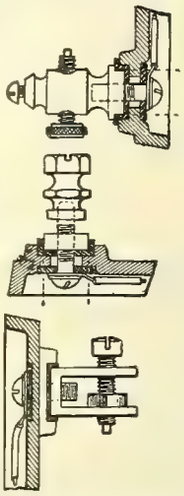

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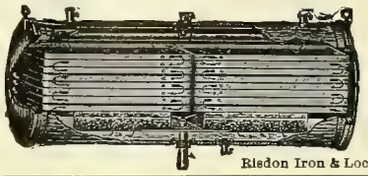

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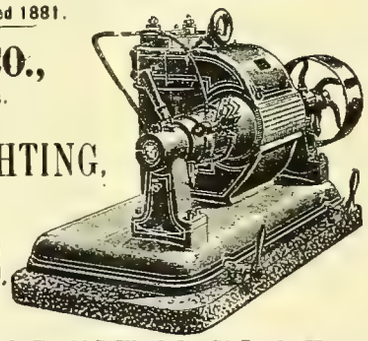

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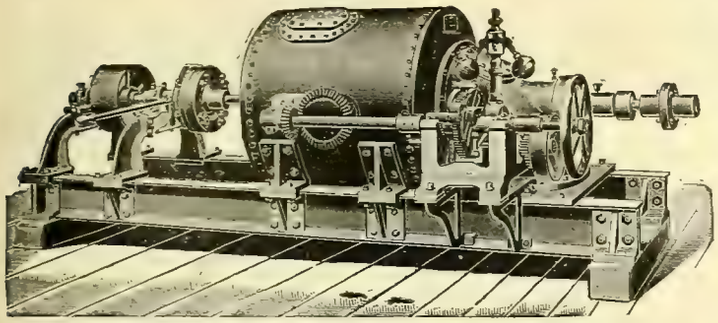

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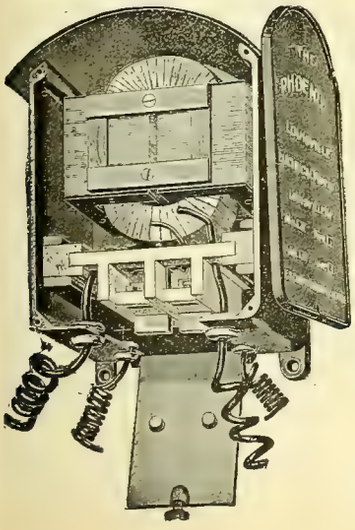

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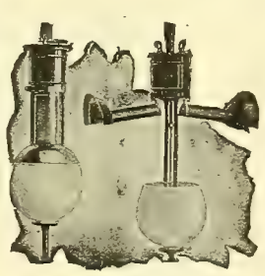

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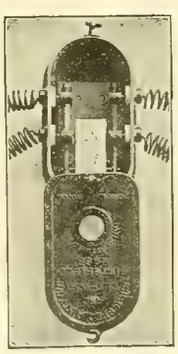

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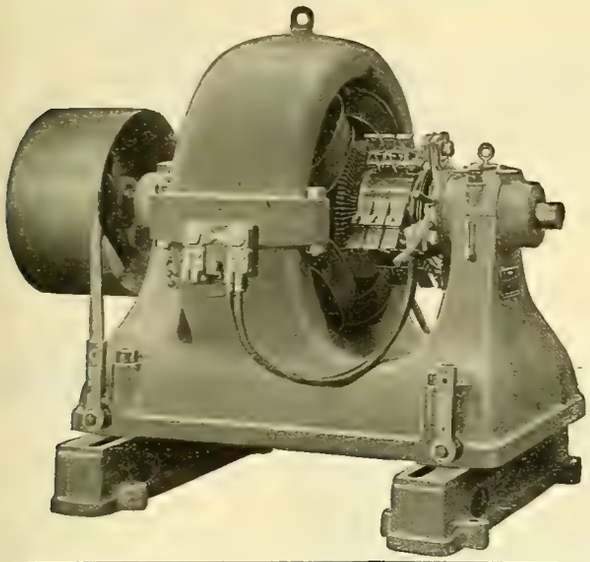

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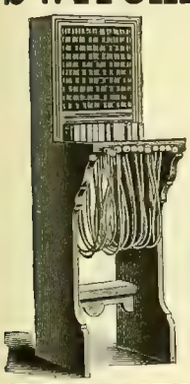

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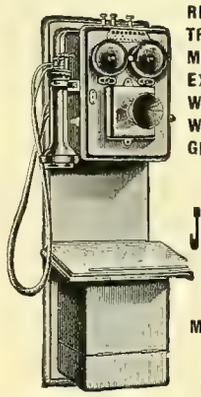

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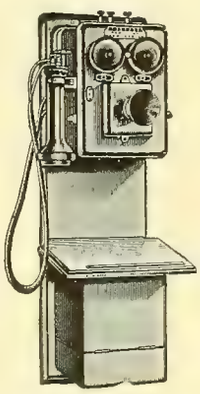

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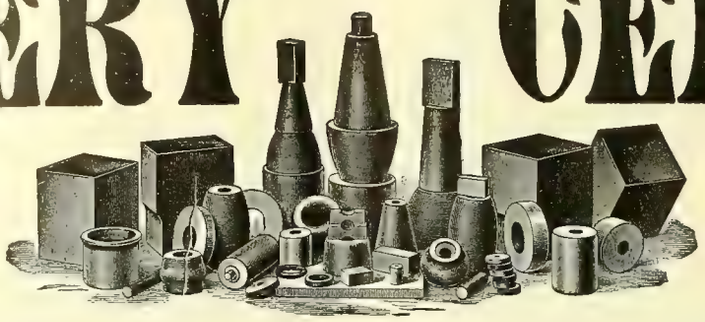

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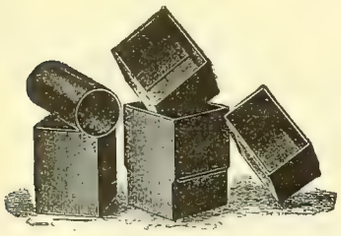

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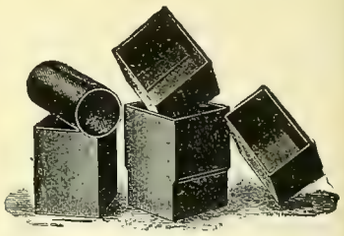

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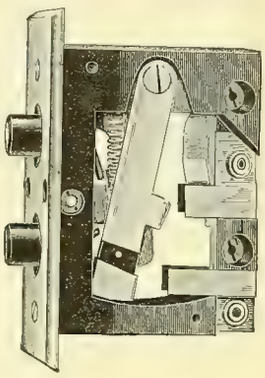
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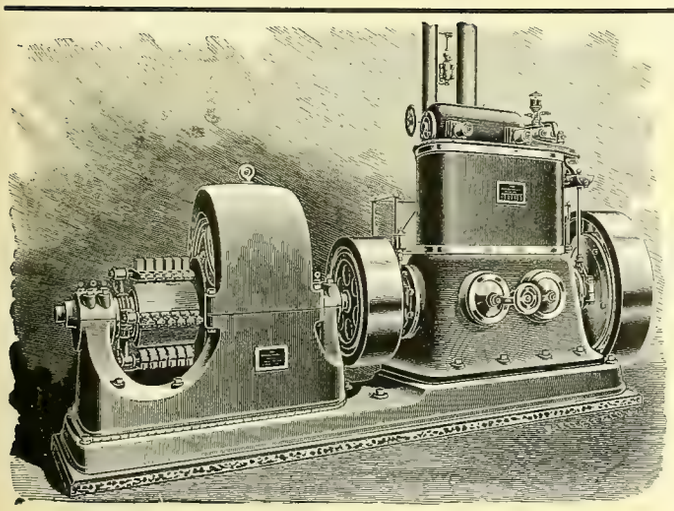

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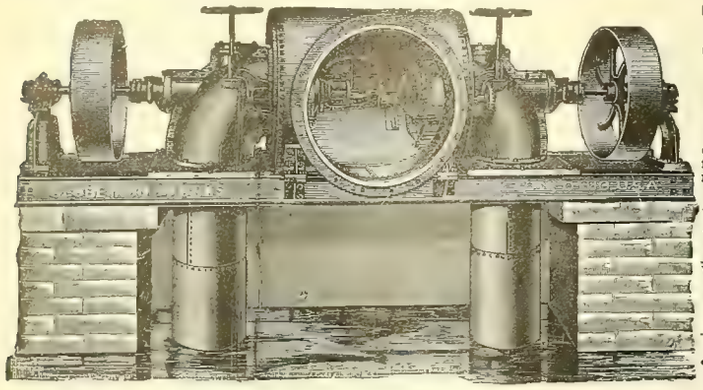

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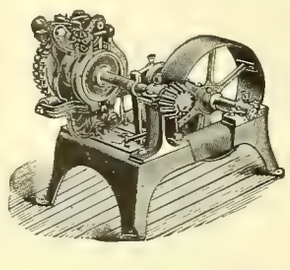

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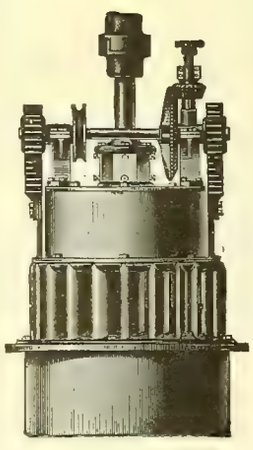

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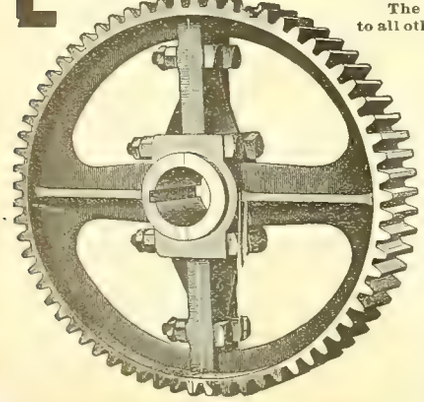

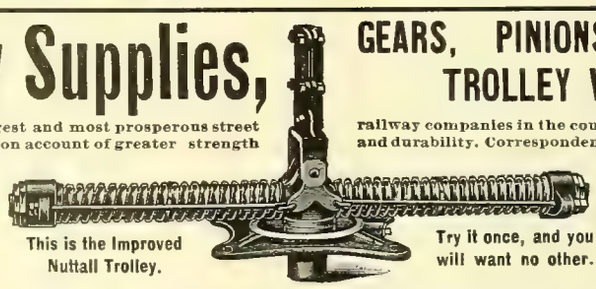

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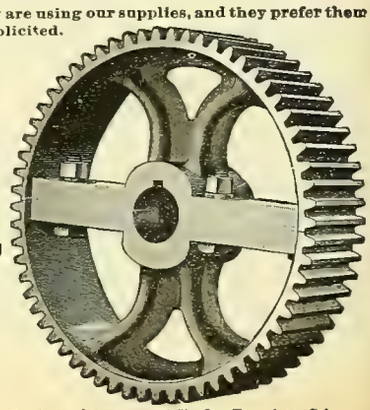

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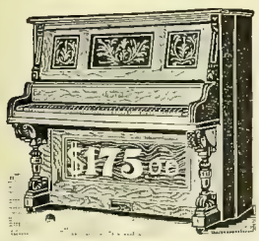

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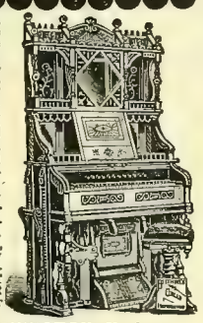

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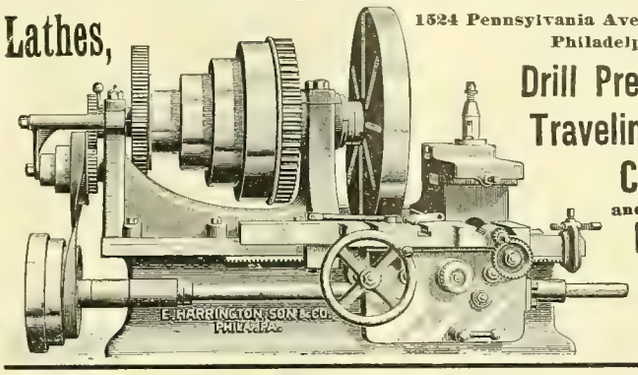


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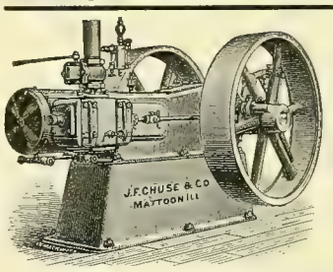


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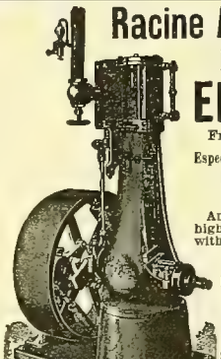

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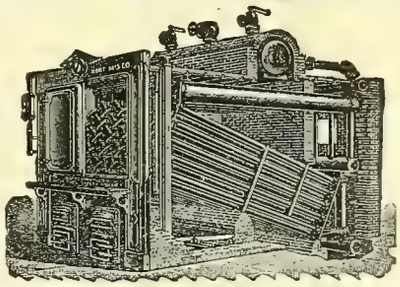

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| 21 | 18.0 | 10 | 18 0 | 10 | 15.8 | 10 | 13.2 | 9 | 600 |
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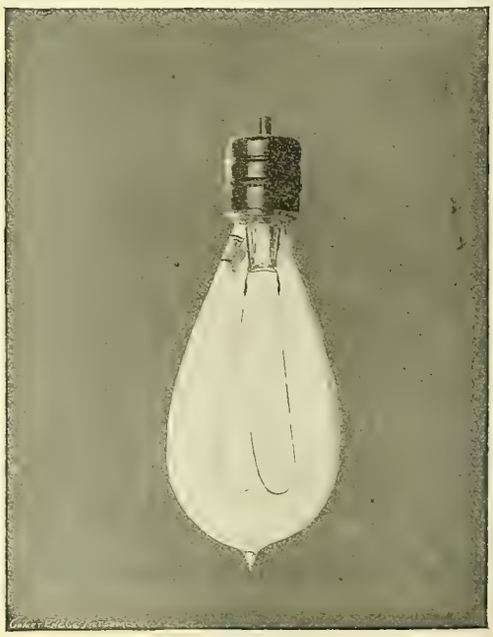

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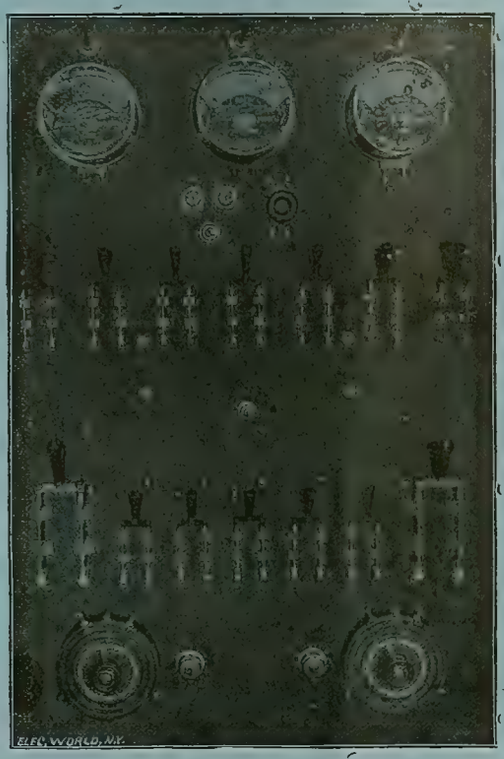


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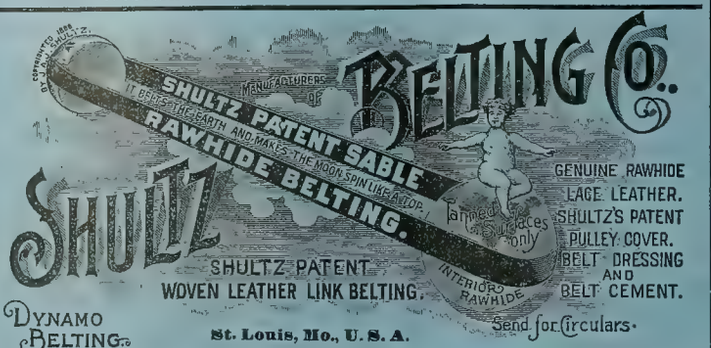


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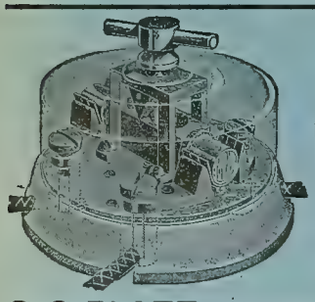

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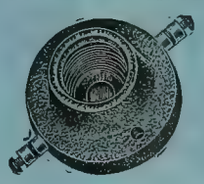

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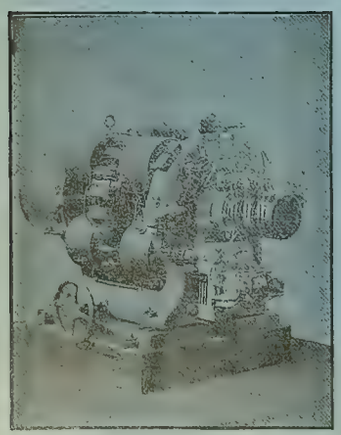

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Vol. XVII. CHICAGO, NOVEMBER 16, 1895. No. 20



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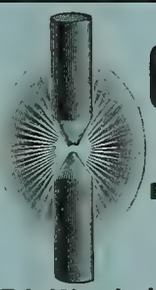

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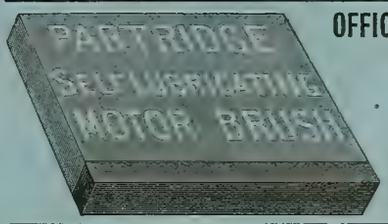


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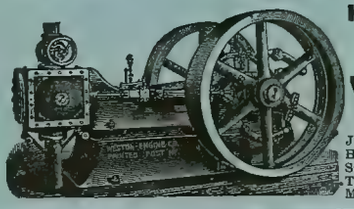

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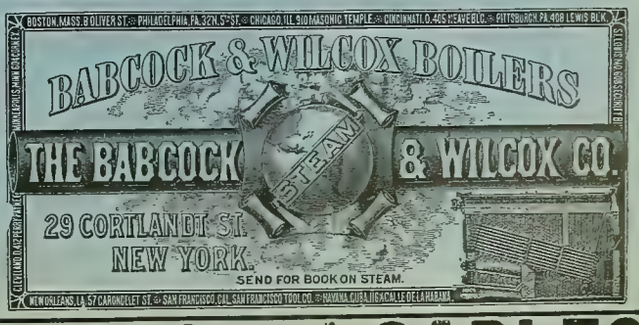


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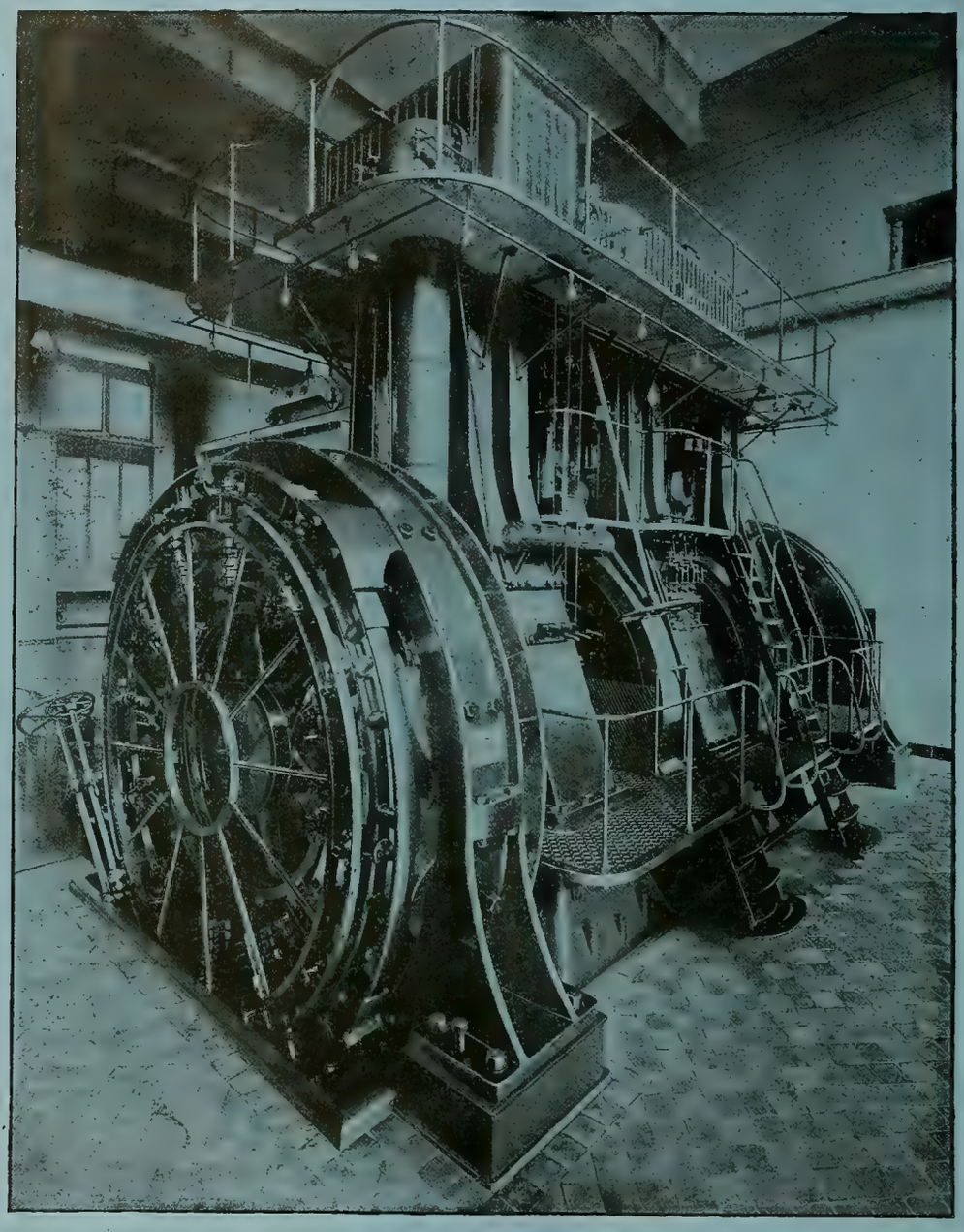

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Chicago Gen'l Fixture Co.
Colgate Co., Geo. L.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric Protection Co.
Farr Tel. & Const. Supply Co.
Forest City Elec. Wks.
General Electric Co.
Indianapolis Elec. Co.
Interior Conduit & Ins. Co.
Louisville Elec. Wks.
MacCurdy & Smith.
Metropolitan Electric Co.
Partrick & Carter Co.
Peru Elec. Mfg Co.
Platt, O. S.
Queen & Co. Inc.
Sioux City Brass Works.
S. K. C. Specialty Co.
Standard Tel. & Elec. Co.

**Globes and Electrical Glassware.**
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Edwards, W. S. Mfg. Co.
Peru Elec. Mfg. Co.

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Lombard Water Wheel Gv. Co.

**Graphite Specialties.**
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.

**Hard Rubber Goods.**
Butler Hard Rubber Co.
Fiberite Co., The.
Newton Rubber Wks.

**Heating, Electric.**
Bowen, W. J.

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Andrae & Sons, J.
Brixey, W. R.
Bunnell & Co., J. H.
Butler Hard Rubber Co.
Central Electric Co.
Chisholm & Co., A.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Empire China Works.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Hart & Hegeman Mfg. Co.
Indianapolis Elec. Co.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Locke, Fred M.
Louisville Elec. Wks.
MacCurdy & Smith.
Munsell & Co., Eugene.
National India Rubber Co.
Newton Rubber Wks.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Partrick & Carter Co.
Peru Elec. Mfg. Co.
Phillips Insulated Wire Co.
Platt, O. S.
Simplex Electrical Co.
Standard Underground C. Co.

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Brixey, W. R.
Bunnell & Co., J. H.
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Eastern Electric Cable Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
General Electric Co.
Independent Electric Co.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
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Buckeye Electric Co.
Central Electric Co.
Columbia Inc. Lamp Co.
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Ft. Wayne Elec. Corporation.
General Electric Co.
Globe Electric Light Co.
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Electric Appliance Co.
General Electric Co.

**Machinery Wipers.**
Am. Silk Mfg. Co.

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Card Electric Co.
Central Electric Co.
Colburn El. Mfg. Co.
Eddy Elec. Mfg. Co.
Elec. Engr. & Supply Co.
Ft. Wayne Elec. Corporation.
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Hartley Elec. Wks.
Indianapolis Elec. Co.
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Sioux City Brass Works.
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Stanley Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
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Garlock Packing Co.

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MacCurdy & Smith.

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Keystone Telephone Co.
Standard Tel. & Elec. Co.
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Brixey, W. R.
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We guarantee all our Cells.

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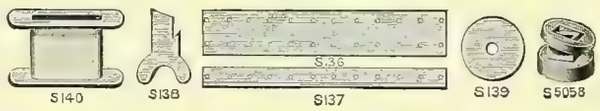


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Moulded Mica Trolley Insulating Materials, Frogs, Crossings, Tree Insulators, Weatherproof Sockets, etc.

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Generators for Power Transmission or Isolated Lighting.
CARD Generators are all Multipolar and Slow Speed.

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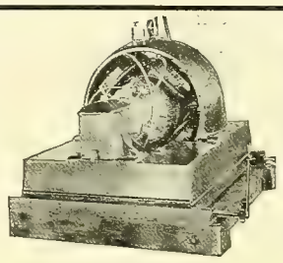

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Reversible Motors and Controllers for Rolling Mills, Bridges and Traveling Cranes.

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The better the material the greater the satisfaction. The customer is content because he realizes, in the contemplation of good work, that he has received his money's worth.

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Two of the greatest factors in good work are **Okonite Wire** and **Interior Conduit.**

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New Face Plate.

**BETTER PROPORTIONS. BETTER FINISH. MORE DURABLE.**

Made of solid plate brass $\frac{1}{8}$-inch thick, with beveled edges.

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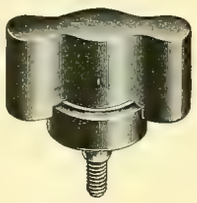

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Handles, Switches and Face Plates Interchangeable.

Single Plates for all sizes of Hart Switches.
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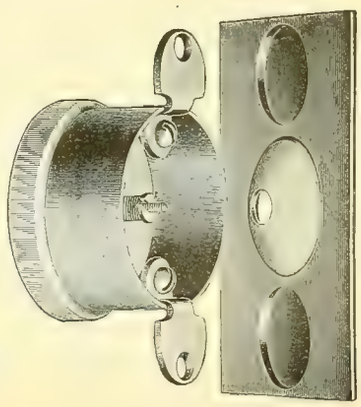

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We do not guarantee our lamps to do anything except to burn satisfactorily, but this we certainly do guarantee.

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**HIGH GRADE NUERNBERG CARBONS**

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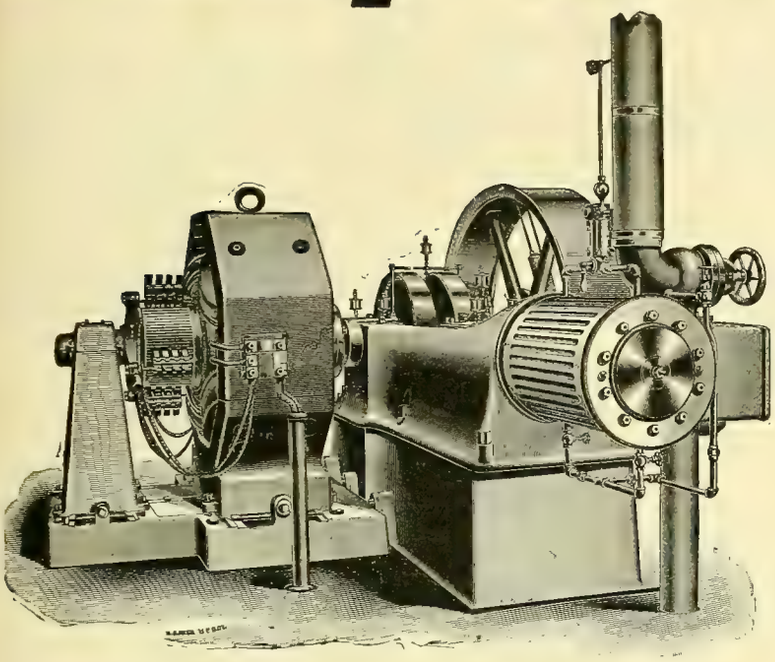

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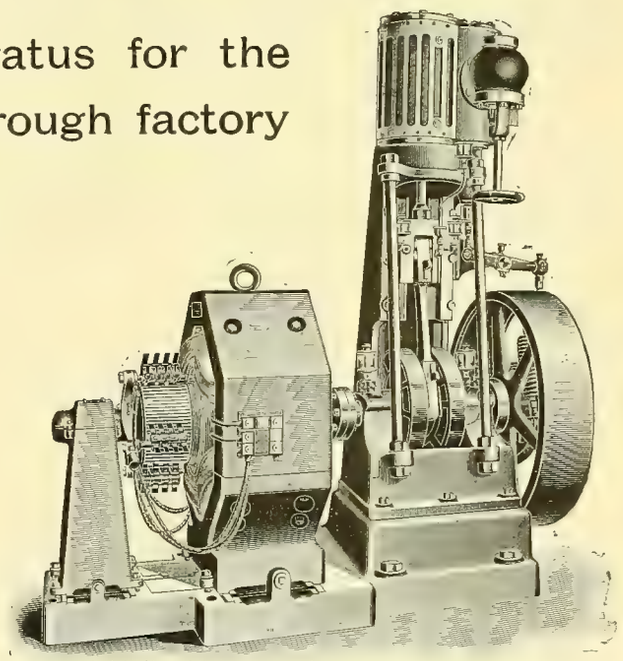
We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.



## All Our Apparatus Guaranteed As Represented.

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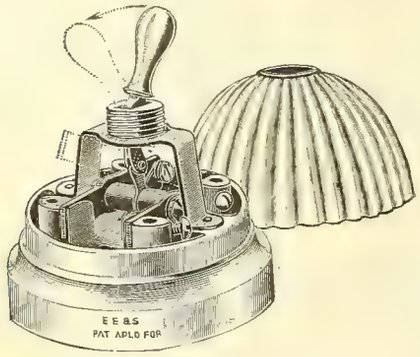


This Switch is in all respects **A KNIFE SWITCH** placed **UNDER** a **COVER.** The break is quick and positive, entirely out of the control of the hand. Contacts and blades are made of pure copper. Easily wired and well proportioned.

Send us your orders and they will be promptly filled.

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# THE ELECTRICAL TRADE

DEVOTED TO ELECTRICAL INTERESTS OF THE SOUTH AND WEST.

Vol. I. No. 1.

1895 NOVEMBER 1895

SUN · MON · TUE · WED · THU · FRI · SAT

MONTHLY CALENDAR AND MOONLIGHT SCHEDULE.

Schedule showing rising and setting of Sun and Moon for New York City, latitude 40½°.
**Good for United States.**
L.—Light. E.—Extinguish.
S.—Sun.
M.—Moon.
Figures left of date indicate rising.
Figures right of date indicate setting.

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | L. 3.30 a. m. E. 5.30 a. m. **1** 6.30 S. 4.57 M. 5.34 | No Light. **2** 6.31 S. 4.56 Full M. Mn. |
| No Light. **3** 6.32 S. 4.54 5.09 M. | No Light. **4** 6.34 S. 4.53 5.51 M. | L. 5.10 p. m. E. 7.40 p. m. **5** 7.35 S. 4.52 6.43 M. | L. 5.10 p. m. E. 8.40 p. m. **6** 6.36 S. 4.51 7.44 M. | L. 5.10 p. m. E. 9.50 p. m. **7** 6.37 S. 4.50 8.54 M. | L. 5.10 p. m. E. 11.10 p. m. **8** 6.38 S. 4.49 10.07 M. | L. 5.10 p. m. E. 12.20 a. m. **9** 6.40 S. 4.48 11.20 M. |
| L. 5.10 p. m. E. 1.00 a. m. **10** 6.41 S. 4.47 12.00 M. | L. 5.10 p. m. E. 1.30 a. m. **11** 6.42 S. 4.46 12.33 M. | L. 5.00 p. m. E. 2.50 a. m. **12** 6.43 S. 4.45 1.48 M. | L. 5.00 p. m. E. 4.00 a. m. **13** 6.44 S. 4.44 3.01 M. | L. 5.00 p. m. E. 5.20 a. m. **14** 6.46 S. 4.43 4.17 M. | L. 5.00 p. m. E. 6.00 a. m. **15** 6.47 S. 4.42 5.34 M. | L. 5.00 p. m. E. 6.00 a. m. **16** 6.48 S. 4.41 New M. Mn. |
| L. 5.00 p. m. E. 6.00 a. m. **17** 6.49 S. 4.40 M. 5.02 | L. 5.00 p. m. E. 6.00 a. m. **18** 6.50 S. 4.39 M. 5.57 | L. 5.00 p. m. E. 6.00 a. m. **19** 6.51 S. 4.39 M. 6.59 | L. 5.00 p. m. E. 6.00 a. m. **20** 6.53 S. 4.38 M. 8.06 | L. 7.30 p. m. E. 6.10 a. m. **21** 6.54 S. 4.38 M. 9.13 | L. 9.00 p. m. E. 6.10 a. m. **22** 6.55 S. 4.37 M. 10.18 | L. 10.20 p. m. E. 6.10 a. m. **23** 6.56 S. 4.36 M. 11.20 |
| L. 11.00 p. m. E. 6.10 a. m. **24** 6.57 S. 4.36 M. 12.00 | L. 11.20 p. m. E. 6.10 a. m. **25** 6.58 S. 4.35 M. 12.21 | E. 6.10 a. m. **26** 6.59 S. 4.35 M. 1.21 | L. 12.20 a. m. **27** 7.00 S. 4.34 M. 2.20 | L. 1.20 a. m. E. 6.10 a. m. **28** 7.02 S. 4.34 M. 3.21 | L. 2.20 a. m. E. 6.10 a. m. **29** 7.03 S. 4.24 M. 4.24 | L. 3.20 a. m. E. 6.10 a. m. **30** 7.04 S. 4.34 M. 5.29 |

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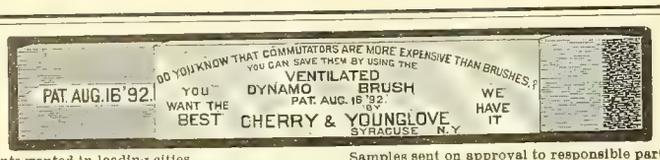


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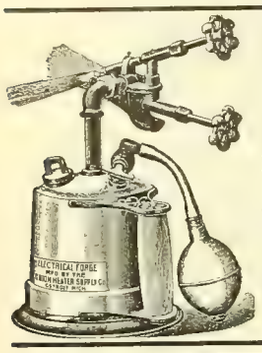

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Ponder the pages of our book; mailed free.

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For Arc Light and Trolley Cord.

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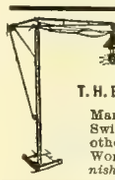

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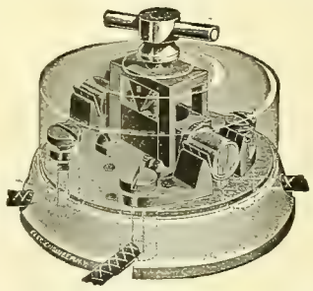

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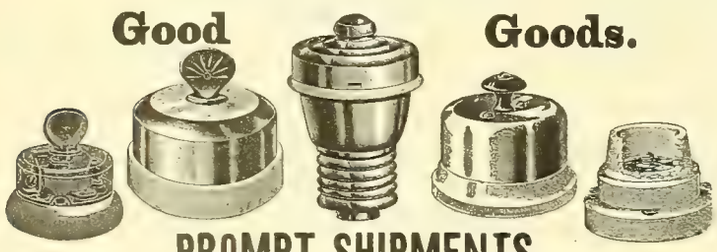

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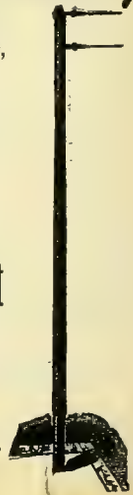

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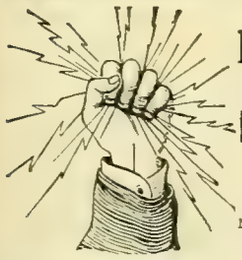

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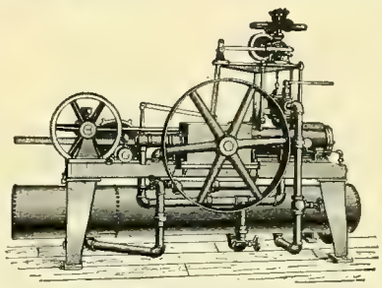

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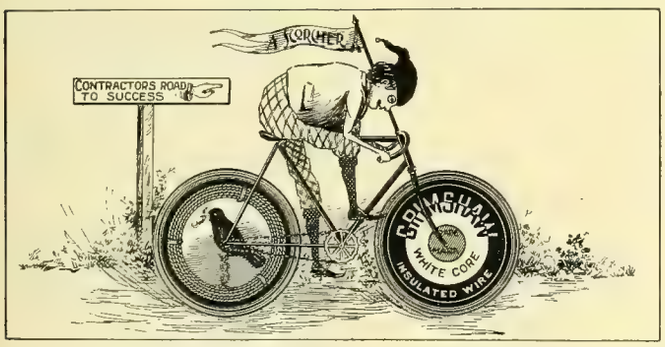


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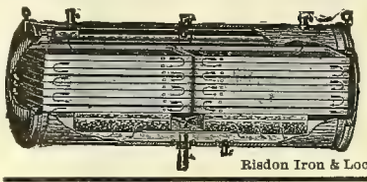

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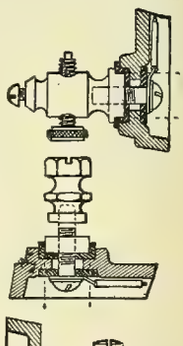

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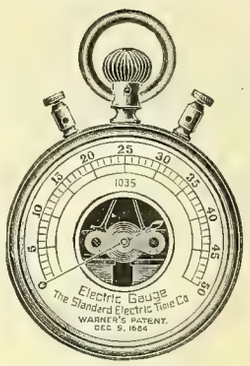


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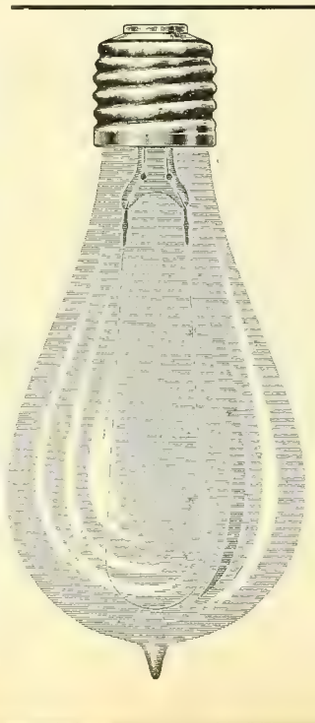

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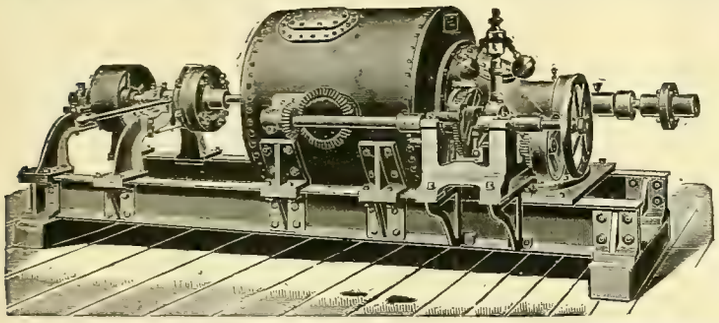

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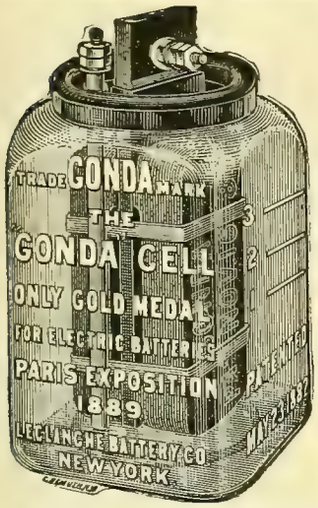


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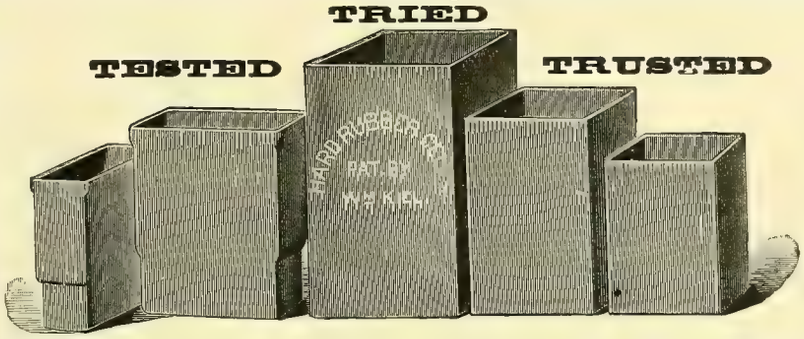

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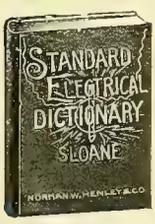


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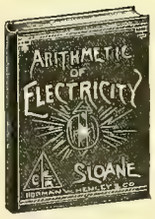


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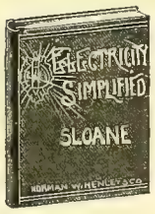


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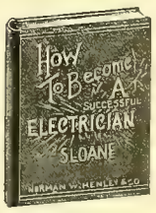


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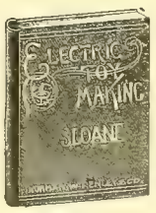


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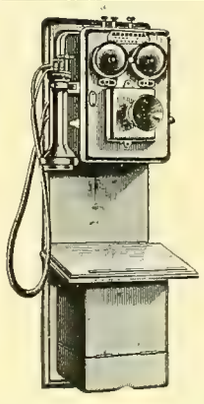

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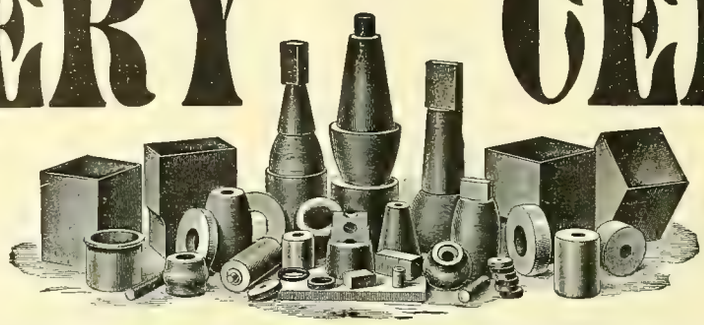

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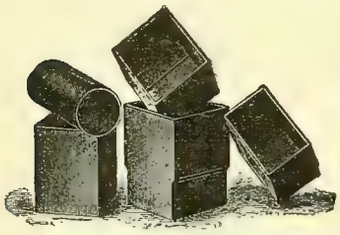

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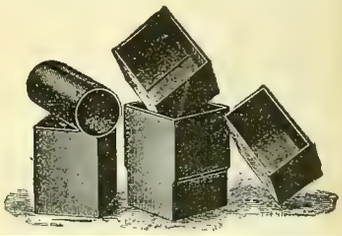

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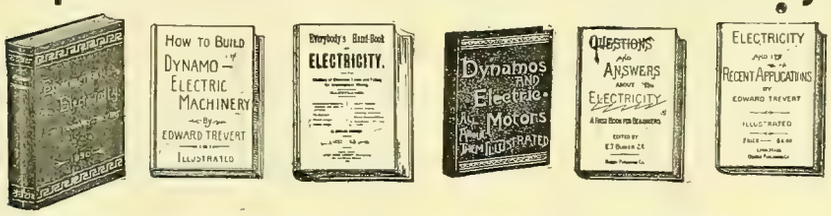


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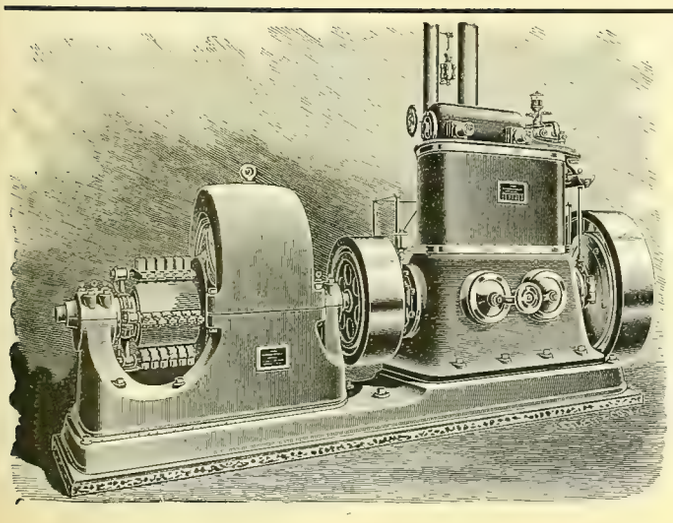

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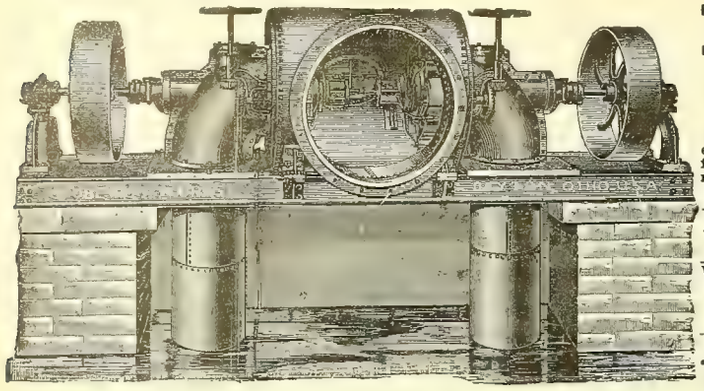

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|---|---|---|---|---|---|
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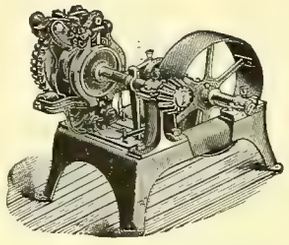

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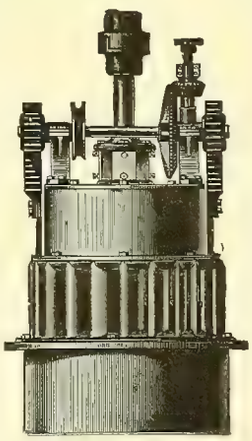

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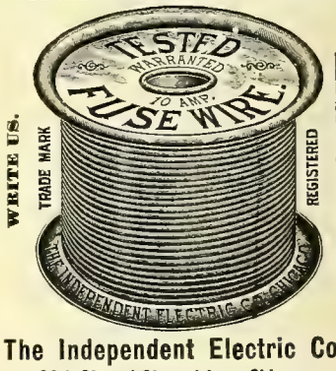


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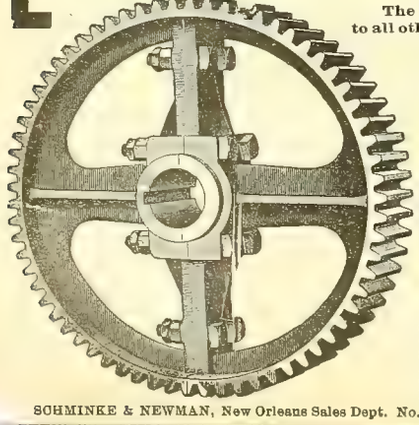

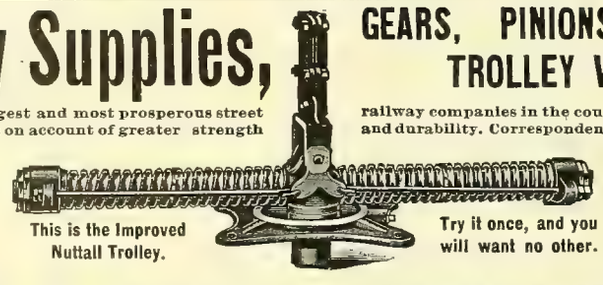

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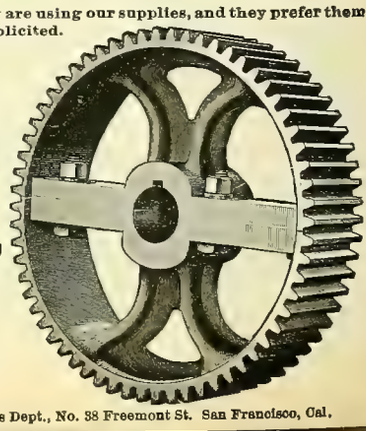

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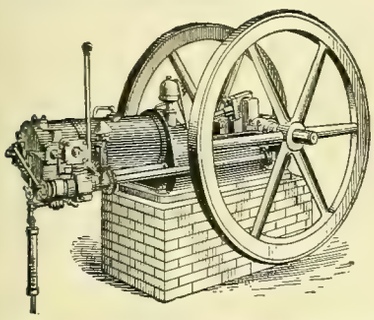

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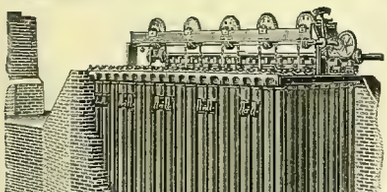

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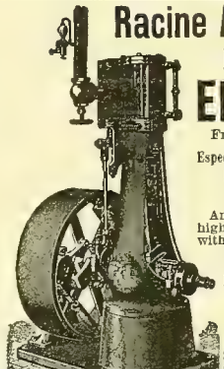

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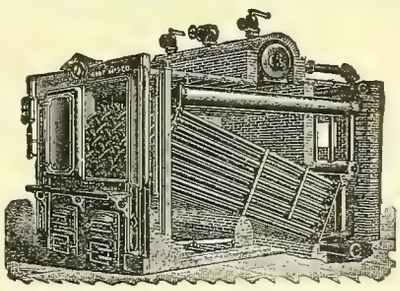

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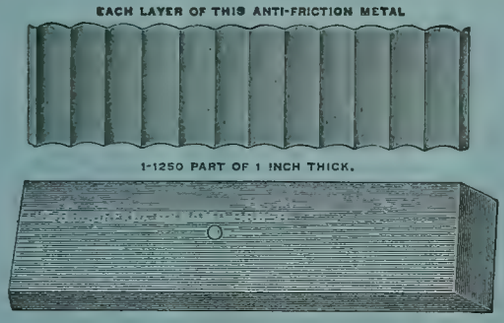


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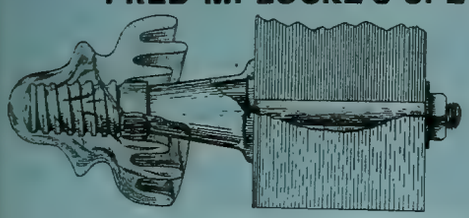

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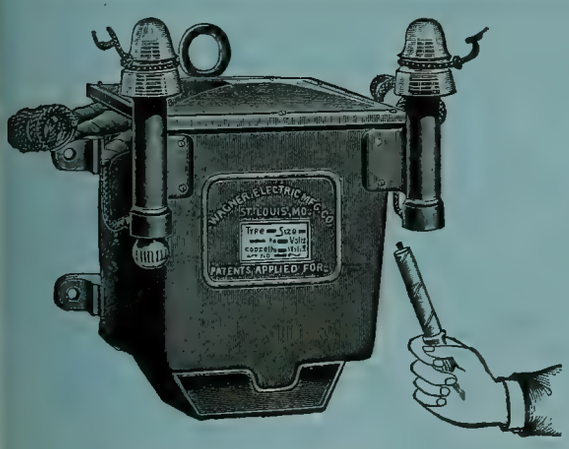


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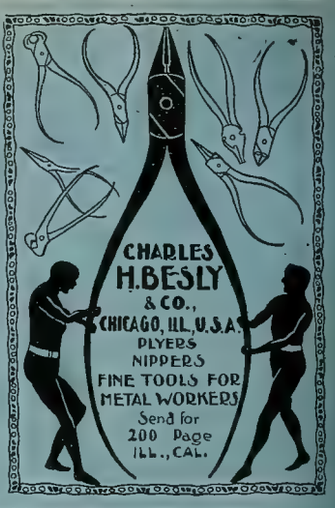


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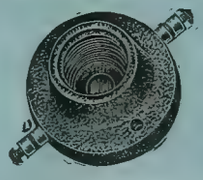

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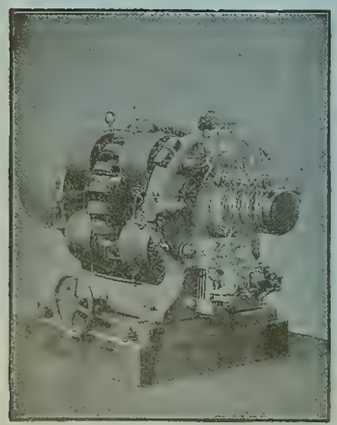

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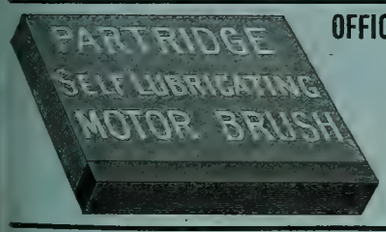


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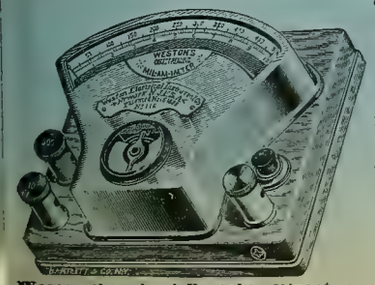

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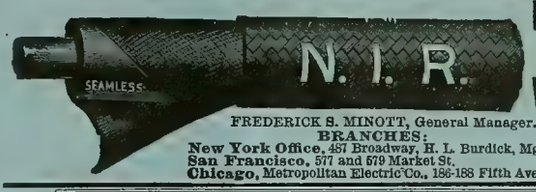


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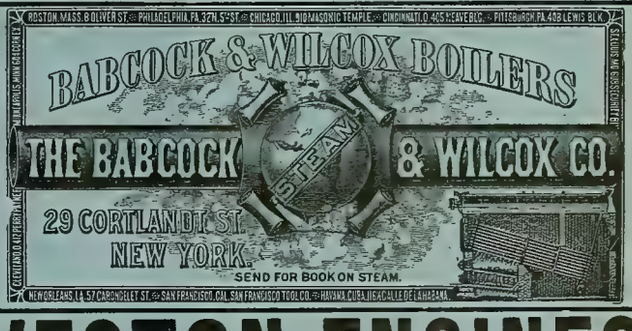


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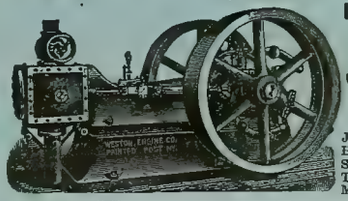

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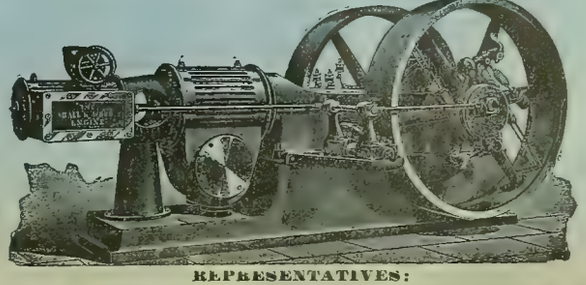

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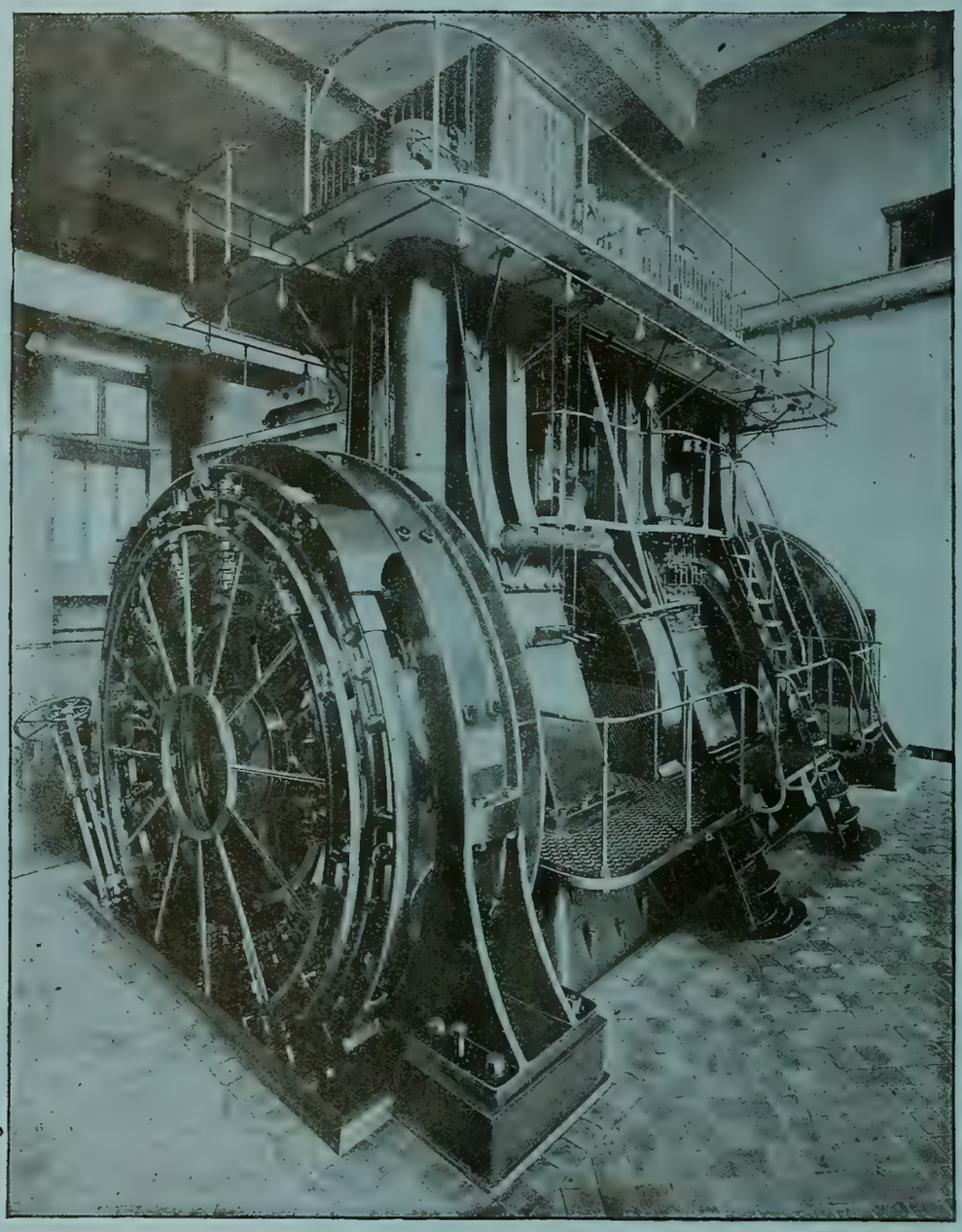

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Bowen, W. J.

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Andrae & Sons, J.
Brixey, W. R.
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Central Electric Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Empire China Works.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Hart & Hegeman Mfg. Co.
Indianapolis Elec. Co.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Locke, Fred M.
Louisville Elec. Wks.
MacCurdy & Smith.
Mica Insulator Co.
Munsell & Co., Eugene.
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New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
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Phillips Insulated Wire Co.
Platt, O. S.
Simplex Electrical Co.
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Eastern Electric Cable Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
General Electric Co.
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Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
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Phillips Insulated Wire Co.
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Standard Underground C.Co.

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Am. Electrical Mfg. Co.
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Central Electric Co.
Columbia Inc. Lamp Co.
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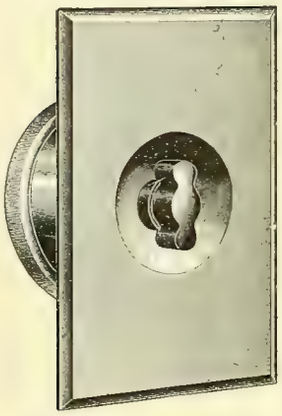

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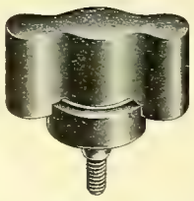

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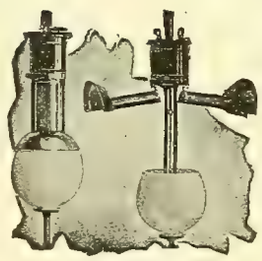

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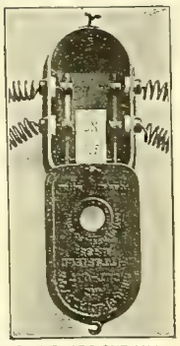

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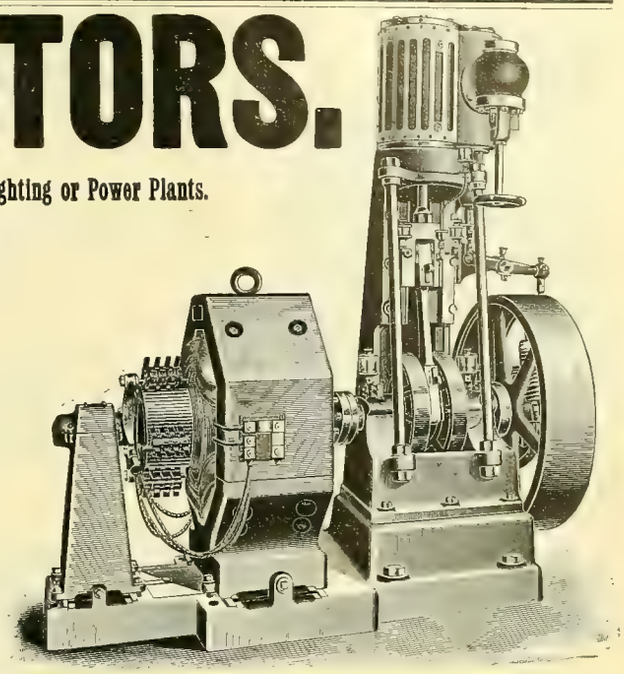

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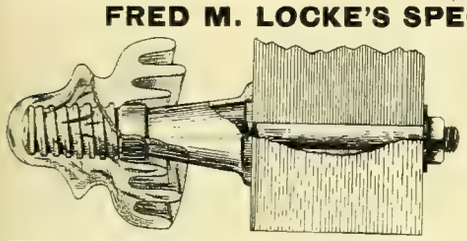

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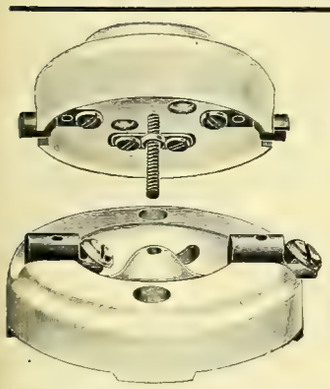

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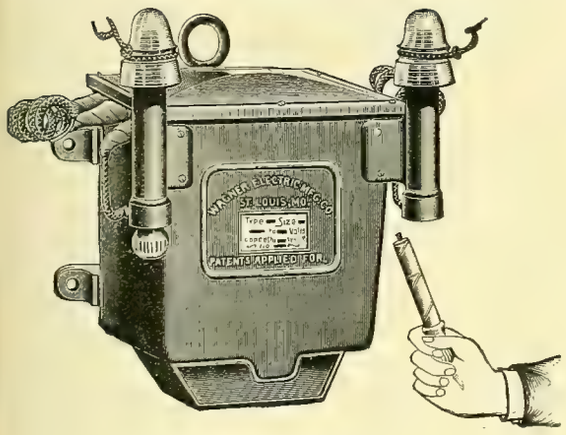


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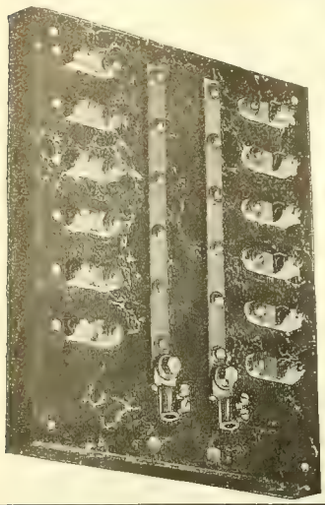

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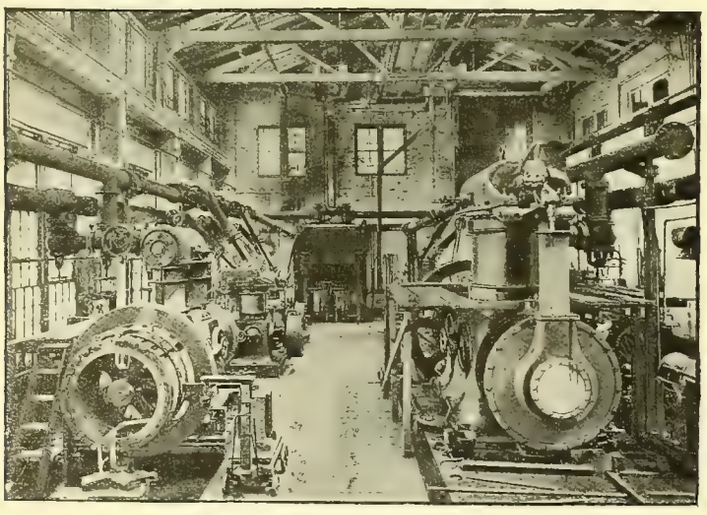

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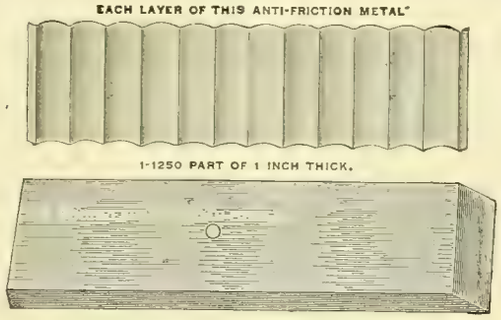


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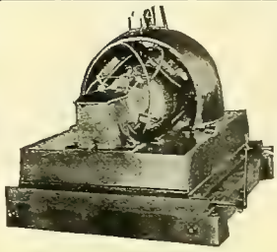

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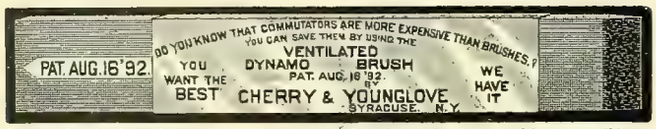


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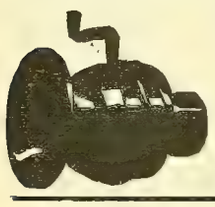

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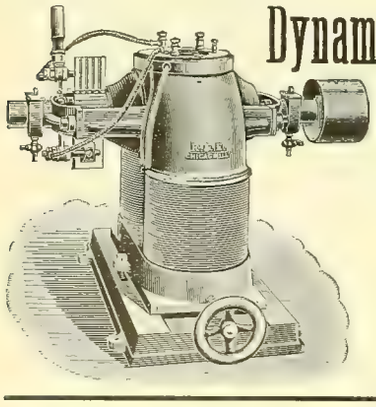

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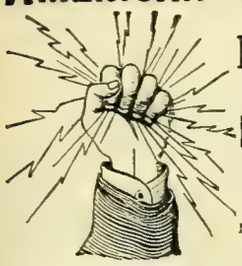

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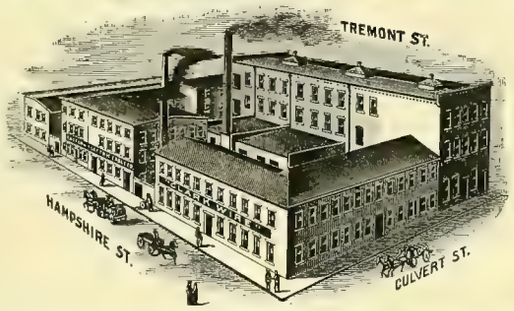


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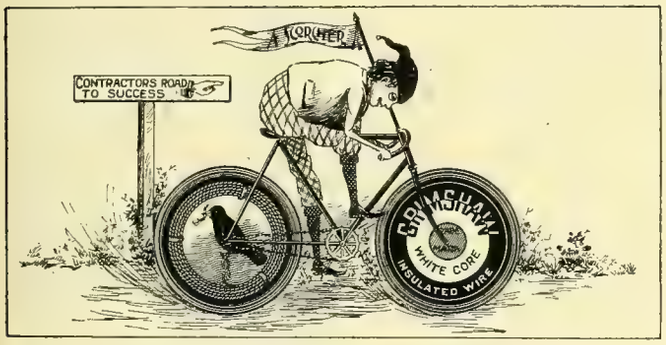


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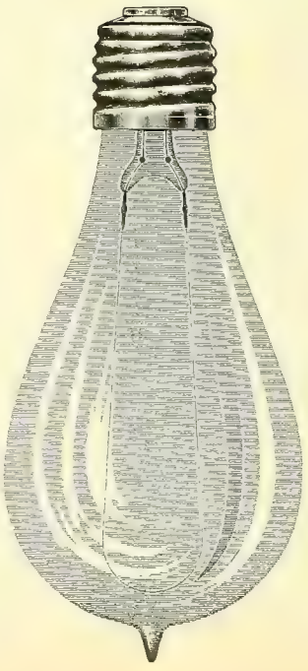

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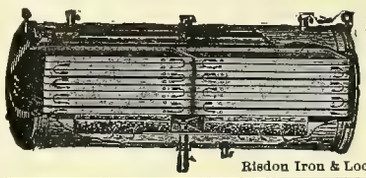

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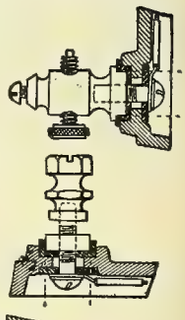

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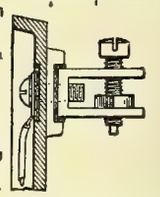

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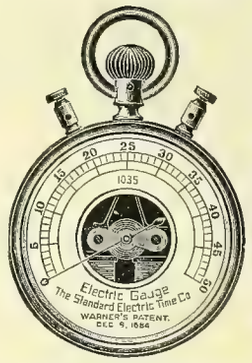


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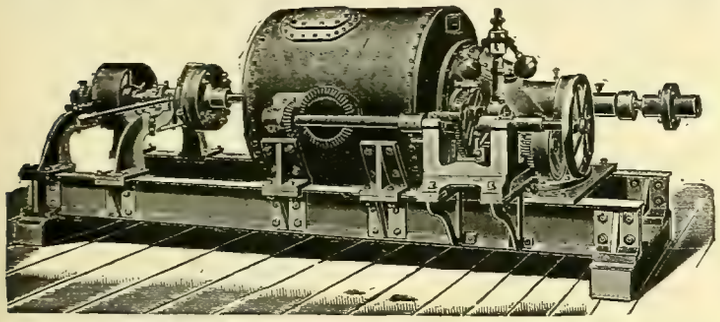

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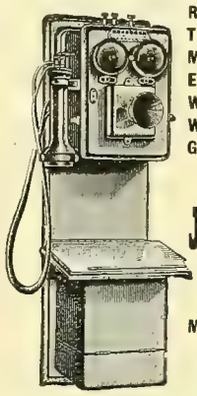

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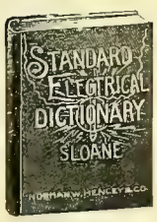


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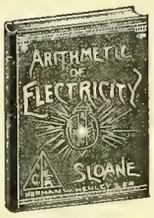


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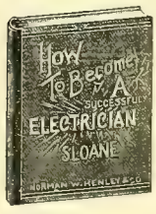


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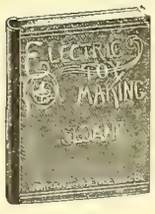


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**Altoona Phœnix Telephone Company,**
OFFICE: ROOMS 14 AND 15, PHŒNIX BLOCK.

H. PRICE GRAFFIUS, PRESIDENT. JOHN M. HAMER, GEN'L MANAGER.
A. V. DIVELY, TREASURER. WILLARD P. BEARDSLEY, SECRETARY.

WESTERN TELEPHONE CONSTRUCTION COMPANY,
Chicago, Ills.;

Altoona, Pa., Nov. 4th, '95.

GMNTLEMEN:--

We are in receipt of your recent favor concerning the offering for sale by the American Electric Telephone Company, of Kokomo, Indiana, of the apparatus of your Company used by us, and in reply thereto please note:

The American Electric Telephone Company did not purchase from us the apparatus furnished by you and they had no authority whatever to offer the same for sale.

We had some difficulty with our line from this city to Hollidaysburg which parallels an Electric Street railway for about five miles, and which the American Electric Telephone Company claimed to be in the switchboard and agreed to remedy the same.

Upon the arrival, however, of your Mr. Stitch, and his going over the matter with our General Manager, he has made the wrong right, and our lines and telephones are now working satisfactory.

Very Respectfully Yours, ALTOONA PHOENIX TELEPHONE COMPANY,
Per H. PRICE GRAFFIUS, Prest.

This Kokomo concern is distressed because we have been called upon to displace the poor apparatus furnished by it in a number of places, (write Armour & Co., Chicago; Cambria Iron Works, Johnstown, and elsewhere) and has resorted to the methods mentioned to offset its unsavory record.

The Western Telephone Construction Co. is a responsible and reliable institution. Its apparatus is too well known to need further statement than that it will endeavor to continue to keep it far in advance of competitors and now ***Guarantees it to be Superior,*** as to Switchboards and Telephones, to any purchasable in the United States.

**CAUTION:** So-called "Hunnings" telephones are almost duplicates of the telephone transmitter rejected by the Government at the recent tests, when "Western" apparatus was adopted. The patent office members of the committee reported on these "Hunnings" telephones: "Upon examination, however, it was discovered that a patent owned by the American Bell Telephone Co. issued to Emil Berliner in 1886, contained claims which specifically cover this instrument."

The same concern that made these "Hunnings" telephones and "blow" about expired patents, also furnished an Arm-Rest Switch, and recently an injunction was granted against the manufacturers of this arm-rest switch.

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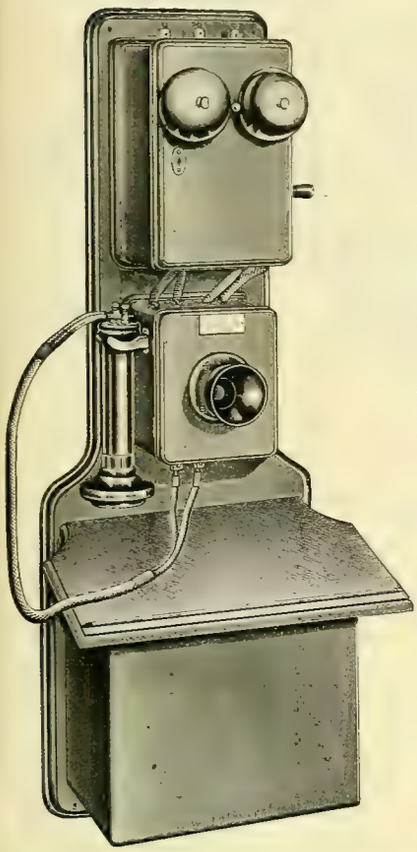

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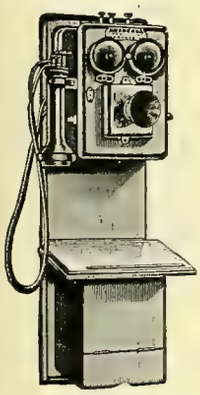

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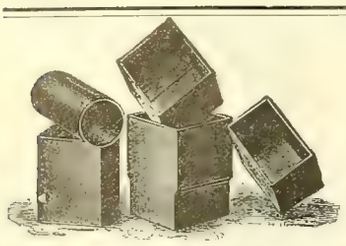

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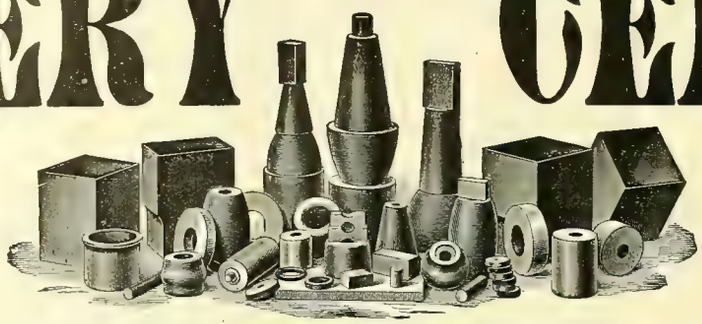

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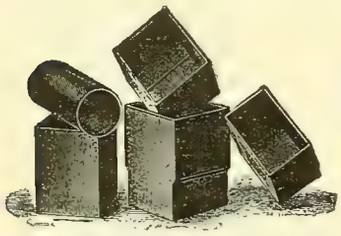

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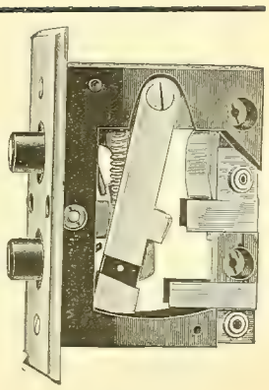
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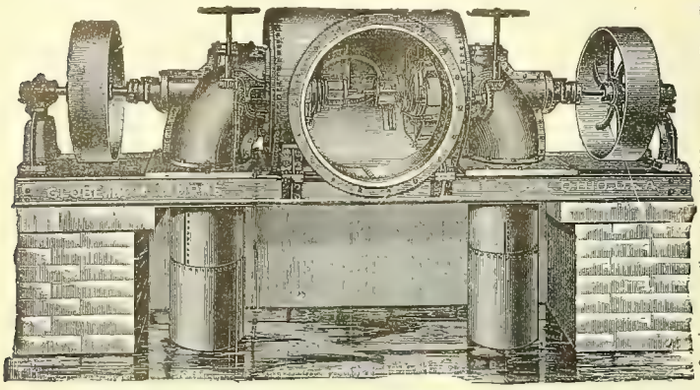

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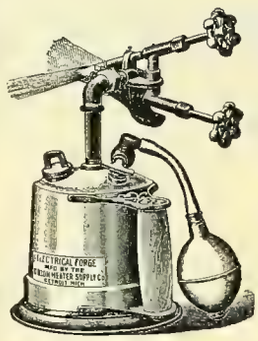

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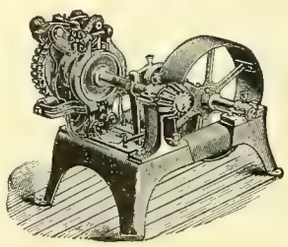

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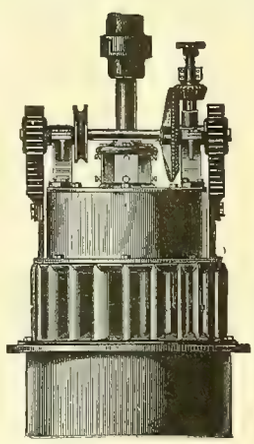

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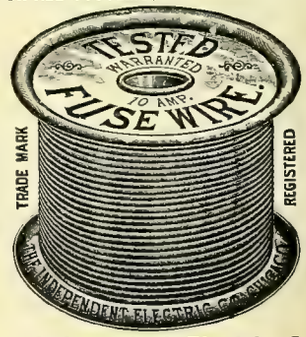


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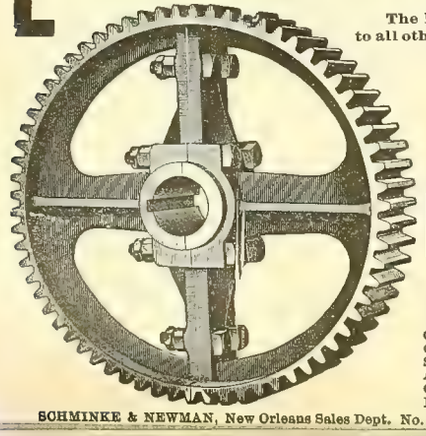

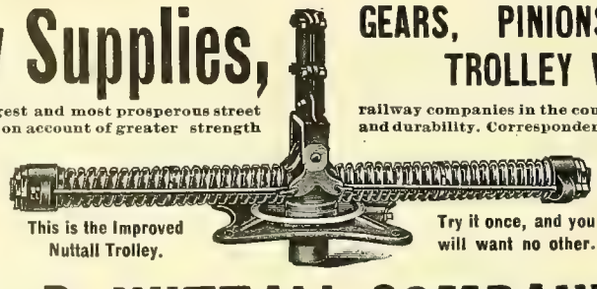

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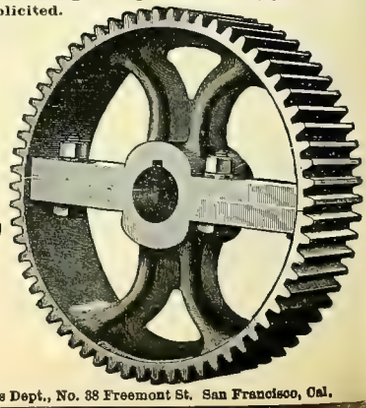

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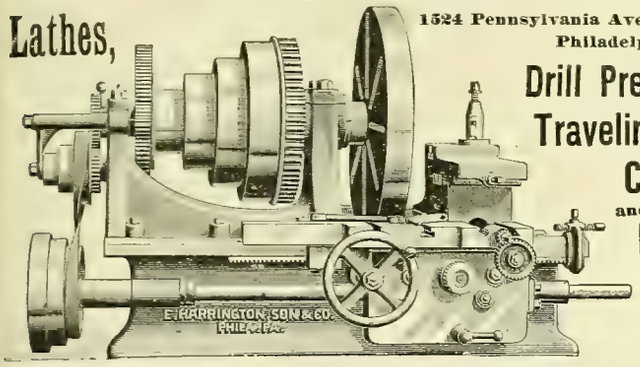


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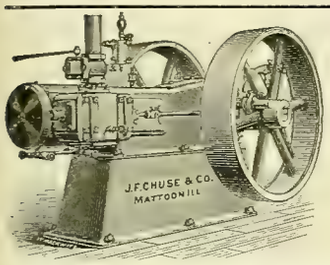


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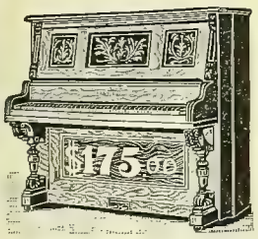


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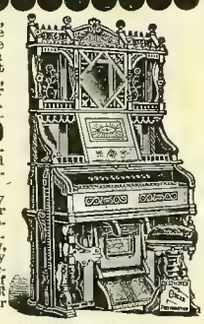

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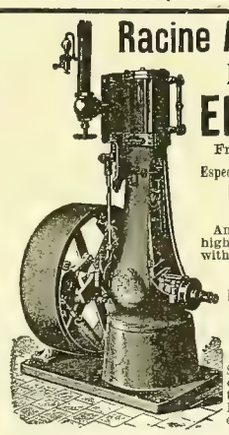

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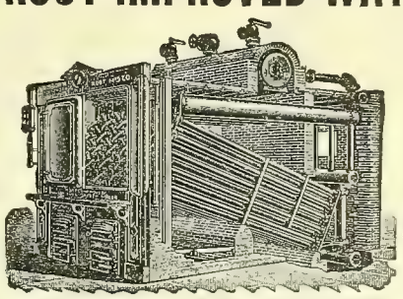

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| 21 | 18.0 | 10 | 18 0 | 10 | 15.8 | 10 | 13.2 | 9 | 600 |
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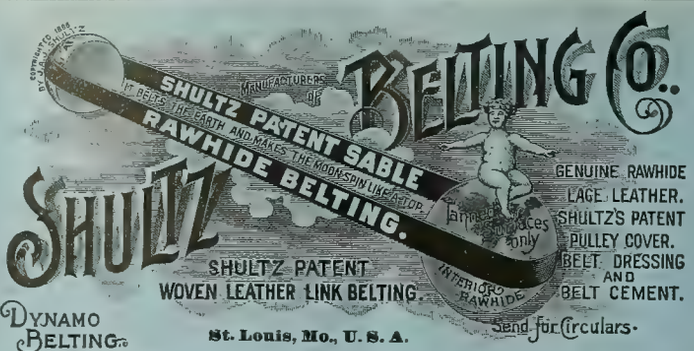


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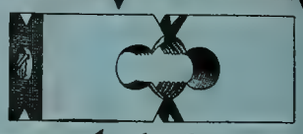

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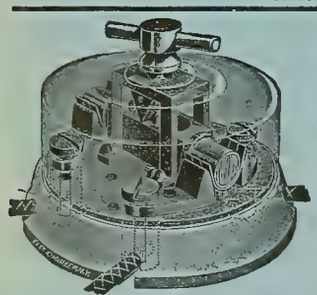

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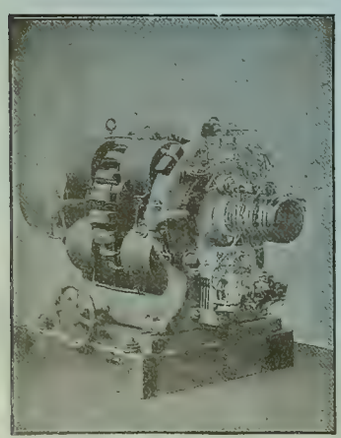

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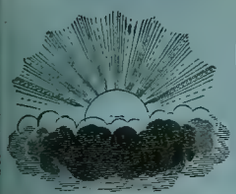

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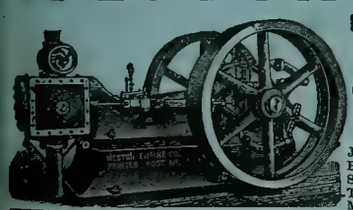

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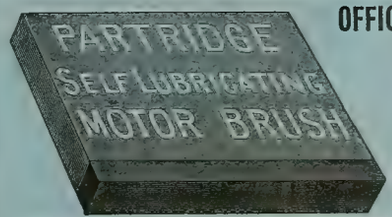


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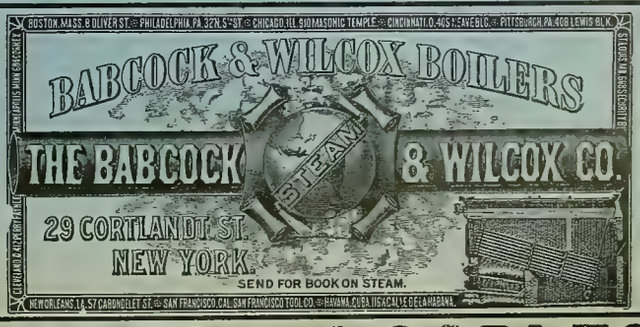


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Foreign Department, Schenectady, N. Y., and 44 Broad Street, New York.
For Canada, address Canadian General Electric Company, Ltd., Toronto, Canada.

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## CLASSIFIED LIST.


**Accumulators.**
Electric Storage Battery Co.
Ohio Storage Battery Co.

**Annunciators.**
Central Electric Co.
Chicago Gen'l Fixture Co.
Electric Appliance Co.
Ostrander & Co., W. R.
Partrick & Carter Co.

**Arc Lamps.**
Adams-Bagnall Elec. Co.
Auerbach-Woolverton El.Co.
Central Electric Co.
Chicago Gen'l Fixture Co.
Ft. Wayne Elec. Corporation
General Electric Co.
Helios Electric Co.
Standard Electric Co.
Standard Thermometer Co.
Waterman C. H.
Westinghouse El. & Mfg. Co.

**Arc Light Cord.**
Samson Cordage Wks.

**Batteries and Jars.**
Andrae & Sons, J.
Boynton Multivolt Batt'y Co.
Butler Hard Rubber Co.
Central Electric Co.
Chicago Gen'l Fixture Co.
Commercial Elec. Sup. Co.
Edgerton Pottery Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric Storage Battery Co.
Gordon-Burnham Bat. Co.
Kester Elec. Mfg. Co.
Leclanche Battery Co., The.
Miamisburg Electric Co.
Newton Rubber Wks.
Ohio Storage Battery Co.
Partrick & Carter Co.
Peru Elec. Mfg. Co.
Western Electric Co.

**Bells.**
Andrae & Sons, J.
Central Electric Co.
Electric Appliance Co.
Ostrander & Co., W. R.
Partrick & Carter Co
Western Electric Co.

**Belting.**
Chicago Belting Co.
Shultz Belting Co.

**Blow Torches.**
Union Heater Supply Co.

**Boilers.**
Abendroth & Root Mfg. Co.
Babcock & Wilcox Co., The.
Clonbrock Steam Boiler Co.
Moyes, L. M.
Murray Iron Works Co.
Racine Hardware Co.
Weston Engine Co.

**Books, Electrical.**
Electrician Publishing Co.

**Bronze.**
Besly & Co., Chas. H.
Phosphor Bronze Sm.Co.,Ltd.

**Brushes.**
Boudreaux Dyn. Brush Co.
Central Electric Co.
Kester Elec. Mfg. Co.
Partridge Carbon Co.
Solar Carbon & Mfg. Co.
Wirt, Chas.
Youngiove & Gere.

**Burglar Alarms.**
Central Electric Co.
Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

**Cables** (See Insulated Wires.)

**Cables, Electric** (See Insulated Wires), **Copper, Sheet and Bar.**
American Elec. Works.
Brixey, W. R.
Central Electric Co.
Eastern Electric Cable Co.
Elec. Engr. & Supply Co.
Moore, Alfred F.
New York Ins. Wire Co.
Simplex Electrical Co.
Standard Underground C.Co.
Western Electric Co.

**Carbons, Points & Plates.**
Central Electric Co.
Chicago Gen'l Fixture Co.
General Electric Co.
Hardtmuth & Co., F.
Partridge Carbon Co.
Reisinger, Hugo.
Solar Carbon & Mfg. Co.
Wertheim Ed.
Western Electric Co.

**Clocks, Watchmen's.**
Southgate & Co., W. B.

**Compound.**
Kester Elec. Mfg. Co.

**Conduits.**
Central Electric Co.
Interior Conduit & Ins. Co.

**Construction & Repairs.**
Ft. Wayne Elec. Corporation.
Hartley Elec. Wks.
Homer & Co., F. E.
Richards & Meacham.

**Contractors and Electric Light Plants.**
Arnold, B. J.
Bain, Foree.
Brush Electric Co.
Bryan, Wm. H.
Card Electric Co.
Chic. Elec.-Mech. Ent. Co.
Eddy Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
Gates Elec. Mfg. Co.
General Electric Co.
Interior Conduit & Ins. Co.
Perkins, Frank C.
Schott, W. H.
Siemens & Halske Elec. Co.
Standard Electric Co.
United Elec Improvement Co
Westinghouse Elec & Mfg. Co.
Western Electric Co.

**Copper.**
Besly & Co., Chas. H.
Miamisburg Electric Co.

**Copper Wires.**
American Electrical Works.
Besly & Co., Chas. H.
Brixey, W. R.
Central Electric Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.
National India Rubber Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Western Electric Co.

**Cordage.**
McEvoy, C. H.
Samson Cordage Wks.

**Cranes.**
Harrington, Son & Co., E.

**Cross-Arms, Pins and Brackets.**
Anderson, Albert & J. M.
Brady, T. H.
Central Electric Co.
Central Mfg. Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Locke, F. M.
Nuttal Co., R. D.
Partrick & Carter Co.

**Cut-Outs and Switches.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Bryant Electric Co.
Central Electric Co.
Chicago Edison Co.
Chicago Gen'l Fixture Co.
Colgate Co., Geo. L.
Commercial Elec. Sup. Co.
Eddy Elec. Mfg. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric Protection Co.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Forest City Elec. Wks.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hart & Hegeman Mfg. Co.
Indianapolis Elec. Co.
Interior Conduit & Ins. Co.
Louisville Elec. Wks.
MacCurdy & Smith.
Nuttall Co., R. D.
Partrick & Carter Co.
Peru Elec. Mfg. Co.
Platt, O. S.
Wagner Elec. Mfg. Co.

**Desks.**
Ithaca Desk Co.

**Dynamos.**
Brush Electric Co.
Card Electric Co.
Central Electric Co.
Colburn El. Mfg. Co.
Eddy Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
Gates Elec. Mfg. Co.
General Electric Co.
Hartley Elec. Wks.
Interior Conduit & Ins. Co.
Roth Bros. & Co.
Siemens & Halske Elec. Co.
Standard Electric Co.
Walker Mfg. Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

**Economizers.**
Fuel Economizer Co.

**Electric Railways.**
Brush Electric Co.
Card Electric Co.
General Electric Co.
Siemens & Halske Elec. Co.
Westinghouse El. & Mfg. Co.

**Electrical and Mechanical Engineers.**
Arnold, B. J.
Bain, Foree.
Bryan, Wm. H.
Chic. Elec.-Mech. Ent. Co.
Eddy Elec. Mfg. Co.
Perkins, Frank C.
Schott, W. H.

**Electrical Instruments.**
Anderson, Albert & J. M.
Central Electric Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Interior Conduit & Ins. Co.
Nuttall Co., R. D.
Partrick & Carter Co.
Platt, O. S.
Queen & Co. Inc.
Southgate & Co., W. B.
Weston Electrical Inst. Co.
Whitney Elec. Inst. Co.

**Electrical Specialties.**
Commercial Elec. Sup. Co.
Electric Protection Co.
S. K. C. Specialty Co.

**Electro-Plating Mach'y.**
Besly & Co., Chas. H.
Colburn El. Mfg. Co.
General Electric Co.

**Engines, Gas.**
Otto Gas Engine Wks.

**Engines, Steam.**
Ball & Wood Co., The.
Chuse & Co., J. F.
Murray Iron Works Co.
Racine Hardware Co.
Westinghouse Machine Co.
Weston Engine Co.

**Engravers.**
Chic. Electro & Stereo Co.

**Fan Outfits.**
Central Electric Co.
Interior Conduit & Ins. Co.
Roth Bros. & Co.

**Feed Water Heaters.**
Goubert Mfg. Co.

**Fibre.**
Butler Hard Rubber Co.
Vulcanized Fibre Co.

**Files.**
Barnett Co., G. & H.

**Forges.**
Union Heater Supply Co.

**Fuse Wire.**
Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.

**Gaskets.**
Peerless Rubber Mfg. Co.

**Gas Lighting, Electric.**
Partrick & Carter Co.

**Gears.**
Besly & Co., Chas. H.
Nuttall Co., R. D.

**General Elec. Supplies.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Berliner Telephone Co.
Besly & Co., Chas. H.
Bryant Electric Co.
Central Electric Co.
Chicago Edison Co.
Chicago Gen'l Fixture Co.
Colgate Co., Geo. L.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric Protection Co.
Farr Tel. & Const. Supply Co.
Forest City Elec. Wks.
General Electric Co.
Indianapolis Elec. Co.
Interior Conduit & Ins. Co.
Louisville Elec. Wks.
MacCurdy & Smith.
Metropolitan Electric Co.
Partrick & Carter Co.
Peru Elec. Mfg. Co.
Platt, O. S.
Queen & Co. Inc.
Sioux City Brass Works.
S. K. C. Specialty Co.
Standard Tel. & Elec. Co.

**Globes and Electrical Glassware.**
Edgerton Pottery Co.
Peru Elec. Mfg. Co.

**Governors, Water Wheel.**
Lombard Water Wheel Gv. Co.

**Graphite Specialties.**
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.

**Hard Rubber Goods.**
Butler Hard Rubber Co.
Fiberite Co., The.
Newton Rubber Wks.

**Heating, Electric.**
Bowen, W. J.

**Insulators and Insulating Materials.**
Anderson, Albert & J. M.
Andrae & Sons, J.
Brixey, W. R.
Butler Hard Rubber Co.
Central Electric Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Empire China Works.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Hart & Hegeman Mfg. Co.
Indianapolis Elec. Co.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Locke, Fred M.
Louisville Elec. Wks.
MacCurdy & Smith.
Munsell & Co., Eugene.
National India Rubber Co.
Newton Rubber Wks.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Partrick & Carter Co.
Peru Elec. Mfg. Co.
Phillips Insulated Wire Co.
Platt, O. S.
Simplex Electrical Co.
Standard Underground C.Co.

**Insulated Wires and Cables—Magnet Wire.**
American Electrical Works.
Brixey, W. R.
Central Electric Co.
Commercial Elec. Sup. Co.
Eastern Electric Cable Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
General Electric Co.
Independent Electric Co.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C.Co.

**Lamps, Incandescent.**
Adams-Bagnall Elec. Co.
Am. Electrical Mfg. Co.
Beacon Lamp Co.
Buckeye Electric Co.
Central Electric Co.
Columbia Inc. Lamp Co.
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Globe Electric Light Co.
New York & Ohio Co.
Partrick & Carter Co.
United Elec. Imp. Co.
Westinghouse Elec. & Mfg Co.

**Lightning Arresters.**
Colgate Co., Geo. L.
Electric Appliance Co.
General Electric Co.

**Machinery Wipers.**
Am. Silk Mfg. Co.

**Magnet Wire.**
(See Insulated Wires.)

**Mechanical Machinery**
Besly & Co., Chas. H.
Harrington, Son & Co., E.
Lukens Iron & Steel Co.
Murray Iron Works Co.

**Mica.**
Johns Mfg. Co., H. W.
Munsell & Co. Eugene.
Schoonmaker, A. O.

**Mining Apparatus, Elec.**
General Electric Co.

**Motors.**
Andrae & Sons, J.
Brush Electric Co.
Card Electric Co.
Central Electric Co.
Colburn El. Mfg. Co.
Eddy Elec. Mfg. Co.
Elec. Engr. & Supply Co.
Ft. Wayne Elec. Corporation.
Gates Elec. Mfg. Co.
General Electric Co.
Hartley Elec. Wks.
Indianapolis Elec. Co.
Interior Conduit & Ins. Co.
Roth Bros. & Co.
Sioux City Brass Works.
Standard Electric Co.
Stanley Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
Walker Mfg Co.
Westinghouse El. & Mfg Co.

**Packing.**
Besly & Co., Chas. H.
Garlock Packing Co.
Peerless Rubber Mfg. Co.

**Paints.**
MacCurdy & Smith.

**Phosphor Bronze.**
Phosphor Bronze Sm.Co Ltd.

**Pianos and Organs.**
Beethoven Piano & Organ Co

**Platinum.**
Baker & Co.

**Poles.**
Hart, C. S.
Lewis, A. L.
Morris, Tasker & Co.
Nuttall Co., R. D.

**Porcelain.**
Commercial Elec. Sup. Co
Empire China Works.
General Electric Co.
Locke, F. M.
Peru Elec. Mfg. Co.

**Publishers, Electrical.**
Electrician Publishing Co.

**Push Buttons.**
Central Electric Co.
Electric Appliance Co
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**Rheostats.**
Central Electric Co.
General Electric Co.

**Sal Ammoniac.**
Klipstein & Co., A.

**Speaking Tubes.**
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Electric Appliance Co.
Ostrander & Co., W. R
Partrick & Carter Co.

**Speed Indicators**
Besly & Co., Chas. H.
Colgate Co., Geo. L.
Queen & Co. Inc.
Weston Electrical Inst. Co
Whitney Elec. Inst. Co.

**Springs.**
Barnes, Wallace.

**Steam Heating.**
Goubert Mfg. Co.
Webster & Co., Warren.

**Storage Batteries.**
Electric Storage Battery Co.
Ohio Storage Battery Co.

**Street Cars.**
Brill, J. G. Co.

**Tapes, Insulating.**
American Electrical Works.
Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co.
Okonite Co., The.
Simplex Electrical Co.

**Telegraph Apparatus.**
Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

**Telephones and Telephone material.**
Andrae & Sons, J.
Berliner Telephone Co.
Central Electric Co.
Commercial Elec. Sup. Co.
Farr Tel. & Const. Supply Co
Gustafson, W. A.
Indianapolis Elec. Co.
Keystone Telephone Co.
McEvoy, C. H.
Richards & Meacham.
Standard Tel. & Elec. Co.
U. S Tel. Const. Co.
Western Electric Co.
Western Tel. Const. Co.

**Transformers.**
Central Electric Co.
Chicago Gen'l Fixture Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hartley Elec. Wks.
Louisville Elec. Wks.
Stanley Electric Mfg. Co.
Wagner Elec. Mfg. Co.

**Trolley Cord.**
Samson Cordage Wks.

**Trucks, Electric Car.**
General Electric Co.
Westinghouse El. & Mfg. Co.

**Turbine Wheels.**
Dayton Globe Iron Works Co.
Leffel & Co., Jas.
Replogle Governor Wks.
Smith, S. Morgan.
Stillwell-Bierce & Smith-Vaile Co.

**Universities.**
Cor. School of Technology.
Int. Corr. Schools.

**Water Wheels.**
Leffel & Co., Jas.
Replogle Governor Wks.
Smith, S. Morgan.

**Wire, Bare.**
Anderson, Albert & J. M.
Besly & Co., Chas. H.
Brixey, W. R.
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Electric Appliance Co.
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electrical supplies

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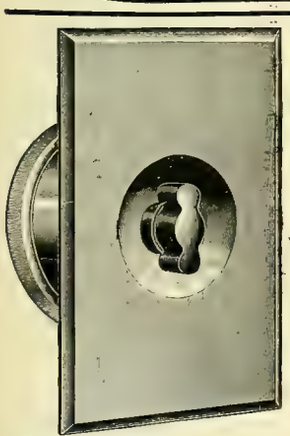
ST. LOUIS, MO.

NEW ORLEANS: 1010 Canal St.
BUFFALO: 112 White Bldg.

Gate City Electric Co.
KANSAS CITY, MO.



No. 1 Plate for 5 and 10 Amp. Hart Switches.

# HART FLUSH SWITCHES.

New Face Plate.

**BETTER PROPORTIONS. BETTER FINISH. MORE DURABLE.**

Made of solid plate brass $\frac{1}{8}$-inch thick, with beveled edges.

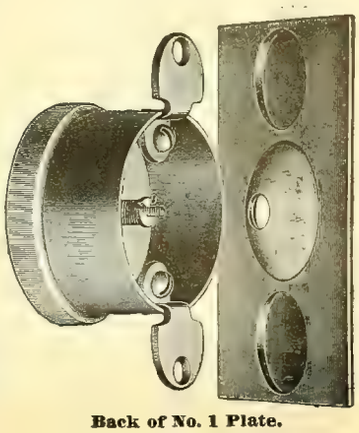
Better Design,
Better Material,

Self-Adjusting Handle,
No Breaking,

No Binding on Face Plates,
No Loose Face Plates.
Handles, Switches and Face Plates Interchangeable.

Single Plates for all sizes of Hart Switches.
Gang Plates for any number of Hart Switches.

**SEND FOR "CATALOGUE B."**



Back of No. 1 Plate.

**THE HART & HEGEMAN MFG. CO.,** HARTFORD, CONN.

# INCANDESCENT LAMPS.

WE MANUFACTURE THE "GLOBE." LIFE AND EFFICIENCY GUARANTEED.

New Process of Exhaustion by Mechanical Vacuum Pump. Absolutely Dry Vacuum. Samples and Prices Furnished on Application. Correspondence Solicited.

## GLOBE ELECTRIC LIGHT CO., 6 Clifton St., ROXBURY, MASS.

AGENTS WANTED. WRITE US.

# The S. K. C. Two Phase Alternating Current System.

THE FIRST AND ONLY COMPLETE AND PERFECTED SYSTEM BY WHICH LIGHT AND POWER CAN BE SUPPLIED FROM THE SAME GENERATOR AND CIRCUITS. POWER TRANSMISSION AND DISTRIBUTION MADE PRACTICAL AND COMMERCIALLY SUCCESSFUL.

## POINTS OF SUPERIORITY:

Our system is much more simple and consequently more durable than any other, either direct or alternating.

Our generator is much more efficient than any other alternator, requires less attention and absolutely no supplies except lubricant for bearings.

It is practically self-regulating without the loss of energy involved by compounding or compensating. Other multi-phase machines require a balance of load.

We have entirely eliminated from our generators the usual sources of trouble, expense and interruption of service: i. e., the revolving armature, commutator, collector rings, brushes, etc.

They can be built for any voltage from 110 for isolated lighting to the high voltages required for power transmission work; in latter case doing away with the expense and loss of step-up transformers; the usual central station machine can be connected at will for either 1,000 or 2,000 volts.

The motors excel in simplicity of construction; in starting torque and simplicity of starting device; in efficiency in the manner in which they take current in proportion to their load, and in uniformity of speed under different conditions of load.

Our transformers insure satisfactory service and the greatest economy. We are prepared to fill all orders promptly, and carry a full stock of transformers in Chicago.

**Patents**—Our apparatus is novel, different from anything heretofore made, and covered by patents that fully protect us and our customers. We are not infringing patents belonging to others, and shall avail ourselves of the patents under which we operate to protect ourselves from piracy by other manufacturers.

## STANLEY ELECTRIC MANUFACTURING CO., PITTSFIELD, .... MASS.

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# The "Electra" Carbons.

IMPORTED

## HIGH GRADE NUERNBERG CARBONS

"TRADE MARK"

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FOR DIRECT CURRENT ARC LAMPS. FOR ALTERNATING CURRENT ARC LAMPS.

Are by far the most economical and efficient manufactured. They produce a very brilliant and absolutely steady light, burning without any dust.

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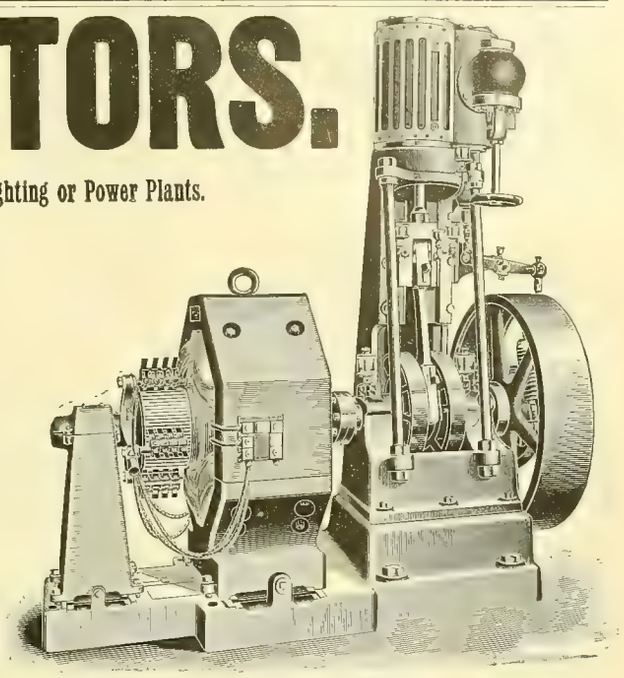
## HUGO REISINGER, NO. 38 BEAVER STREET, NEW YORK.

Sole Importer for the United States and Canada.

# EDDY GENERATORS.



Direct Connected or Belted for Electric Railways, Central Stations, Isolated Lighting or Power Plants.

## EDDY MOTORS—SLOW, MEDIUM OR HIGH SPEED.

*We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.*

## THE EDDY ELECTRIC MFG. CO.,

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BOSTON, G. M. Angier & Co., 64 Federal St.
ELMIRA, S. N. Blake.
ST. LOUIS, Western Electrical Supply Co.
KANSAS CITY. W. T. Osborn.
CHICAGO OFFICE:—305 Dearborn St., Wallace & Hine, Mgrs.

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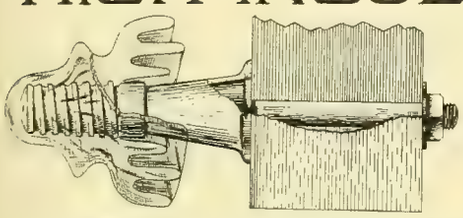

INDESTRUCTIBLE Insulator Pins, **High Potential Insulators in glass and porcelain,** Break Arms, Side Brackets, Cross Arms, Locust Pins, Oak Brackets and all kinds of Glass Insulators and Line Material.

Manufactured by
**FRED M. LOCKE,**
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The Highest Standard of Excellence.

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## Laclede AND Hercules Batteries,

MADE ONLY BY THE

## PERU ELECTRIC MFG. CO.,

PERU, IND.

Also Manufacturers of all kinds of Electric Porcelain.

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**A FULL LINE IN STOCK.**

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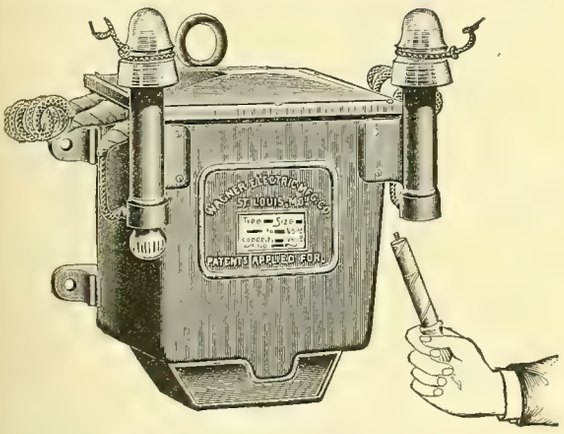
**IF** you are anxious to secure the latest electrical books, **YOU** should write to the Electrician Publishing Co., Chicago. You **CAN'T** procure too many reliable, readable books to **READ.**




60 LT. TYPE D TRANSFORMER.

# WAGNER

**Switches**
**Switchboards**

ELECTRIC MANUFACTURING CO.

**Transformers for all purposes.**
**First in every Competitive test.**
**Acknowledged by all Engineers to be the most efficient and most nearly perfect in mechanical design.**

**General Offices and Factory at St. Louis, Mo.**

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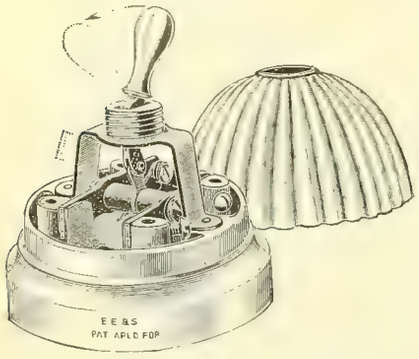
**STORE ROOMS: BOSTON, PHILADELPHIA, SAN FRANCISCO, ST. LOUIS.**

# E. E. & S. CANOPY SWITCH.




This Switch is in all respects **A KNIFE SWITCH** placed **UNDER** a **COVER.** The break is quick and positive, entirely out of the control of the hand. Contacts and blades are made of pure copper. Easily wired and well proportioned.

Send us your orders and they will be promptly filled.

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MANUFACTURERS OF THE

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**ALSO OWNERS OF ALL STORAGE BATTERY PATENTS HERETOFORE CONTROLLED BY**

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**and the**
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All inquiries regarding any of the above batteries should be addressed to

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# GATES ELECTRIC MANUFACTURING CO.,

**BUILDERS OF MODERN, HIGH-CLASS**

## Multipolar Dynamos and Motors,

**DIRECT-CONNECTED AND BELTED.**

Carbon Brushes of Ample Surface on all Machines. New Style Commutator **with Removable Segments.** Iron-Clad Armature **with Flexible Bar Winding.** Armature Core and Commutator built on Sleeve, **with Shaft Removable.** Self-Oiling Ball Bearings.

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# PROFITABLE READING.

The publication of Prof. Thomas' tests on Packard Lamps set all the lamp manufacturers and a large number of intelligent lamp users

## ....THINKING....

Some of them are probably still thinking, but by far the greater number profited by a little study of the subject, and are now using a lamp which is making their

## ...PLANT MORE PROFITABLE...

every day it runs.

## THE PACKARD LAMP WILL DO THIS.

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**Electrical Supplies,**

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READ TESTIMONIAL ON PAGE 270
—OF—
RAINBOW SHEET PACKING.
HAVE YOU USED IT?

Oils, Ammonia or Alkalies do not affect it.

Steam Joints Made Instantly.

NO BAKING OR FOLLOWING UP.
Patented and Manufactured Exclusively by
PEERLESS RUBBER MFG. CO., - 16 Warren St., New York.

CROSS ARMS, PINS AND BRACKETS.

Why not use Yellow Pine Cross Arms?
We also manufacture Oak Pins and Brackets, and GENUINE BLACK LOCUST PINS.
We can ship promptly.
We guarantee our product equal to any in the market.
Correspondence solicited.

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A NEW CIRCULAR describing the
Hoyt Station Ammeters AND Voltmeters
sent free on application.
WHITNEY ELECTRICAL INSTRUMENT CO.,
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ESTABLISHED 1857.
WALLACE BARNES,
*Manufacturer of*
FLAT, COILED AND WIRE
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OF EVERY DESCRIPTION
Send sample for prices. Bristol, Conn

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For Arc Light and Trolley Cord.
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Agents wanted in leading cities. Samples sent on approval to responsible parties
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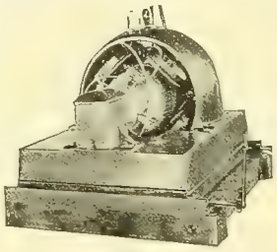
CARD

Generators for Power Transmission or Isolated Lighting.
CARD Generators are all Multipolar and Slow Speed.

AGENTS WANTED IN UNOCCUPIED TERRITORY.



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CARD

Multipolar Slow Speed Stationary Motors.
Reversible Motors and Controllers for Rolling Mills, Bridges and Traveling Cranes.

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*The Bowen Electric Heaters*
EXCEL THEM ALL!
For HEATING TROLLEY CARS, Cabins, Staterooms, Show Windows, Portable Stoves, Etc.
(Patented.)
*REQUIRE THE LEAST POWER.*
Reliable, Durable, Simple, Convenient. Best of all—**Warms the Car** evenly throughout. Adapted to all styles of cars, and every system of circuits. Rights for sale. Correspondence solicited.
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Nothing better for wire soldering. Where once used it is indispensable.
The Flames are Strong Enough to Melt Copper.
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Bryant Electric Company,
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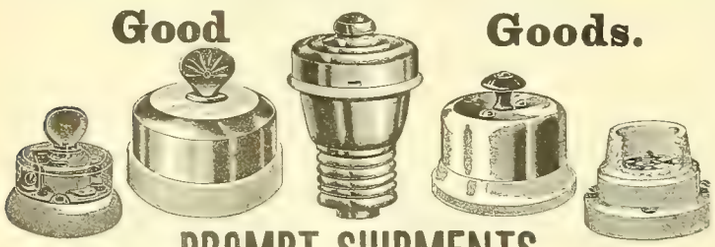

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The R. Thomas & Sons Co. Porcelain is Good.

NOT MUD, BUT PORCELAIN.
P & S
FINE AS ROYAL WORCESTER.

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Manufacturers of
Boiler Tubes, Wrought Iron Pipes and Fittings,
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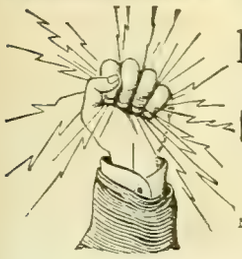

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ELECTRIC LIGHT LINE WIRE,
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Two Wires in a Single Tube, the Standard Method of Electric Wiring.

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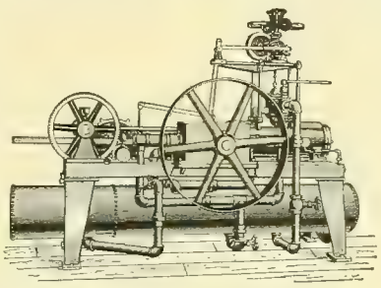
GENTLEMEN:—We have one of your Governors in use at our power house at Millers Falls, Mass., taking care of two water-wheels to perfection, regulating the power *within a few volts.* We took out one Governor and replaced it with a LOMBARD GOVERNOR which gives *perfect satisfaction.* Yours truly, MONTAGUE ST. RY. CO.,
(Signed) H. C. GARFIELD, Supt.



Sold on trial and absolutely guaranteed to hold wheel speed to satisfaction of purchaser, irrespective of sudden changes of load.

Send us a description of your water-wheel plant.

LOMBARD WATER-WHEEL GOVERNOR CO.,

61 HAMPSHIRE STREET, BOSTON, MASS.

The Best on the market.
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PORCELAIN MANUFACTORY.
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GENERATOR AND MOTOR
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MADE NEW, AND OLD SHELLS REFILLED.
EVERY SYSTEM.
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Graphite Rods of Various Lengths, from 1-5 Ohm to 100 Ohms Resistance to the inch. Graphite Boxes and Crucibles, Resisting Heats of 4,000 Degrees. Inquiries Gladly Answered.

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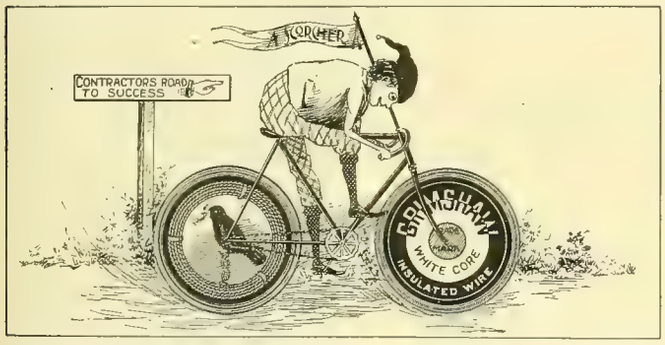


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RAVEN WHITE CORE. Used in some of the largest buildings in the United States.

COMPETITION LINE WIRE. Used by some of the largest Central Stations and Fire and Police Departments in the U.S.

GRIMSHAW TAPES, COMPETITION TAPES AND SPLICING COMPOUNDS.

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## WANTED.

To interest the necessary capital to bring before the public my Automatic Safety Appliance for Electric Wires. It protects life from the most dangerous fallen wires carrying electric currents, and will be required by law.

**A. E. HUTCHINS, Detroit. Mich.**

## POSITION WANTED.

As superintendent of lighting and power station by a practical and experienced central station man, having been in charge of the different departments, and understanding the leading systems for power, arc and incandescent lighting; also construction work and the economical management of steam plants. I will undertake to systematize the working of a plant and put upon an economical basis. First-class references from responsible lighting companies. Address

"Supt." WESTERN ELECTRICIAN.

## WANTED—SITUATION.

By an energetic Engineer and Electrician of several years' experience, in electric light plant, west of Missouri River preferred. Please state full particulars as to size of plant, salary, etc. Will go to work immediately. References.

Address "A,"
Care of WESTERN ELECTRICIAN.

## WANTED.

A competent man to act as foreman of armature department. None but first-class men need apply. Give experience and class of work you have done. Apply

**CANADIAN GENERAL ELECTRIC CO.,**
**Peterboro, Ont.**

## WANTED.

Competent wireman, dynamo tender and central station man. Steady work for right man. Address, stating experience and references,

**TAGONA WATER & LIGHT CO.,**
**Sault Ste. Marie, Ontario.**

## POSITION WANTED.

First class all around telephone man of ten years' experience in construction and repairs. For the past two years have been with manufacturing company assembling and testing telephones and swit hboards Have had experience installing exchanges. Would contract to do all inside work, furnishing telephones switchboards, cables, etc, or make alterations on unsatisfactory exchanges. Address "C. O. R.,"

Care WESTERN ELECTRICIAN.

## FOR SALE.

Small lot of American Gas Engine Electric Co.'s stock; cheap. Address

"C. E. R.,"
Care of WESTERN ELECTRICIAN,
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# Scrap Copper Wire WANTED.

It will pay the Electrical Plants to save their Scrap Copper Wire and ship to us in any quantity, at the following prices, f. o. b. Chicago, cash on receipt of same:

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| Bare Copper Trolley Wire | 9 cts. per lb. |
| Ordinary Bare Copper Wire Scrap, | 8½ " " |
| Insulated Copper Wire | 5 to 8 " " |
| Heavy Red Scrap Brass | 7½ " " |
| Heavy Yellow Scrap Brass | 6¼ " " |
| Light Sheet Brass | 3¾ " " |

We receive metals in any quantity and send prompt returns. We also supply the Electrical trade with Cotton Waste, in bales of 100 and 500 lbs., also Babbitt, in lots of 100 lbs. and over, at the very lowest prices. It will pay you to correspond with us. Address

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**CHICAGO'S LEADING METAL HOUSE,**

Established 1885. **120-122 W. Lake St.,**
Incorporated 1895. CHICAGO, ILL.

Write for Illustrated Catalogue.

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Twenty-seven Courses of Study. Send for *free* circular. State subject you wish to study,

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*POSITIVELY*
The Best Made and Finest Finished Desk on the market for the money. Write for Catalog.
**Ithaca Desk Co., Ithaca, N.Y.**
**$22**

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### A No. 1 Electric Light Plant

At a bargain. In a growing town of 3,000 population, county seat of one of the best counties of Iowa, with three railroads, center of coal region. Coal delivered at furnace for 87½ cents per ton. Has been operated three years. Contract with city for street lighting has two years to run.

110 h. p. A. & S. Engine.
Two 60 h. p. Boilers.
1,500 Incandescent and about
40 Arc Lights, connected.

Address,

**B. S. Hood,**
Jerseyville, Ill.

# Second Hand Engines and Boilers for Sale.

Two 9½x10, double, 125 horse power, Armington & Sims.
One 15x20, 150 horse power, Ide.
One Boiler, 66 in. diameter and 16 ft. tubes,
Two 50-light Westinghouse Alternating Arc Machines with lamps. An excellent factory installation.

All in good order and condition. Only for sale on account of being replaced by larger units.

Also a lot of Dynamo pulleys; prices on receipt of dimensions.

Apply to

## N. B. Gas and Edison Light Co.,

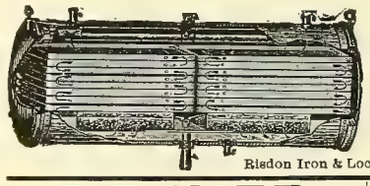
**New Bedford, Mass.**

# FOR SALE, CHEAP!
## NEW 50 LIGHT
# Arc Dynamo.

This machine has never been used. In fact, has not yet been taken out of shop. Is of leading manufacture and will be guaranteed direct to purchaser by makers. Will be sold for **one hundred dollars under market** for cash.

Address **DYNAMO,**
**WESTERN ELECTRICIAN OFFICE.**

# Stilwell's Patent Live Steam-Feed Water Purifier.



**Removes all Impurities.**

Entirely prevents *scale* in Steam Boilers. Catalogue on application.

**The Stilwell-Bierce & Smith-Vaile Co.,**
**DAYTON, OHIO.**

Risdon Iron & Loc'tive W'ks, San Francisco, Cal., Pacific Coast Agt

## C. S. HART,

WHOLESALE

Telegraph, Telephone, Electric Light

**AND STREET RAILWAY POLES.**

Manufactured from Live Cedar peeled. Quick shipments and best quality.

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## A. L. LEWIS,

Wholesale Producer of and Dealer in

## CEDAR POLES AND TIES.

FROM THE STUMP TO THE CONSUMER.

Write for Prices.

**Menominee, - - Michigan.**

## FOR SALE CHEAP.

7½ H. P. 500 Volt C. & C. Motor, 3 H. P. 500 Volt Crocker-Wheeler Motor, and other second-hand machines.

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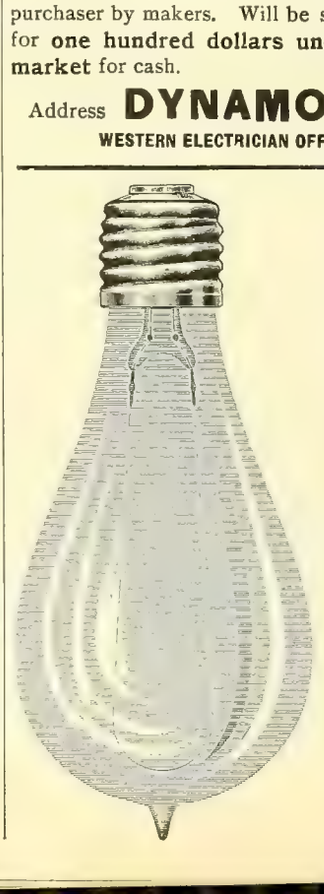

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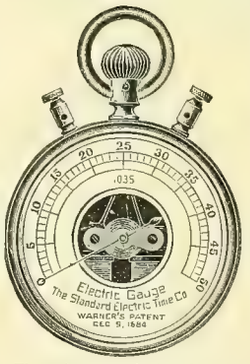


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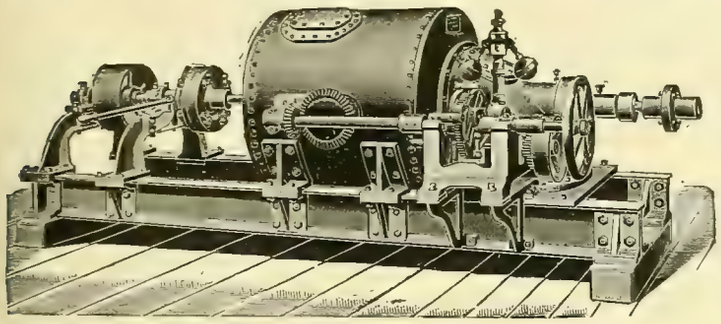

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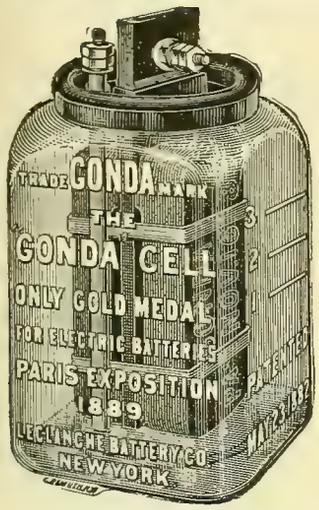


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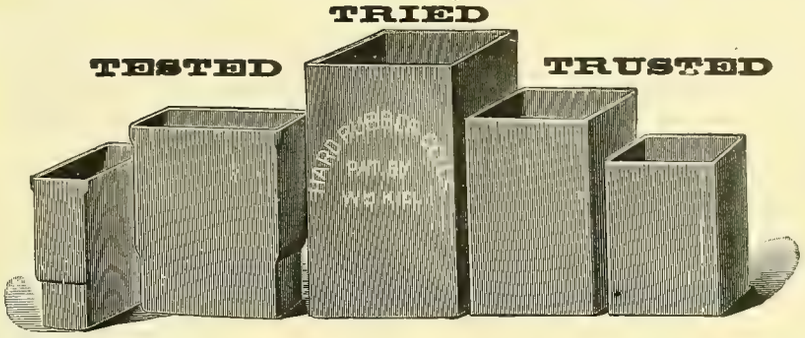

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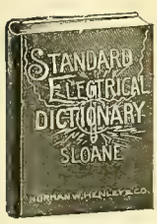


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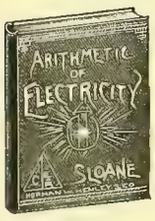


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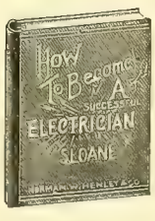


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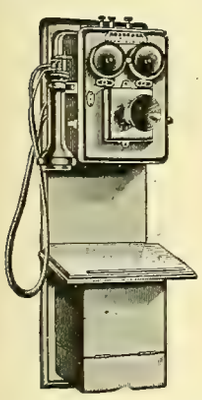

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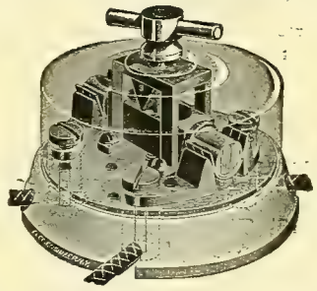

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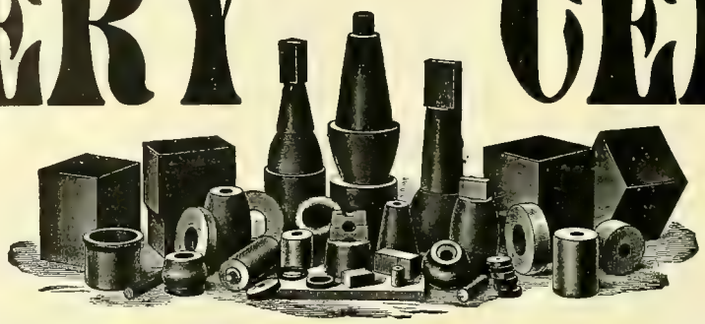

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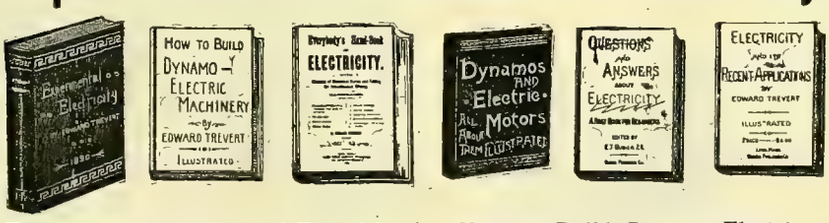


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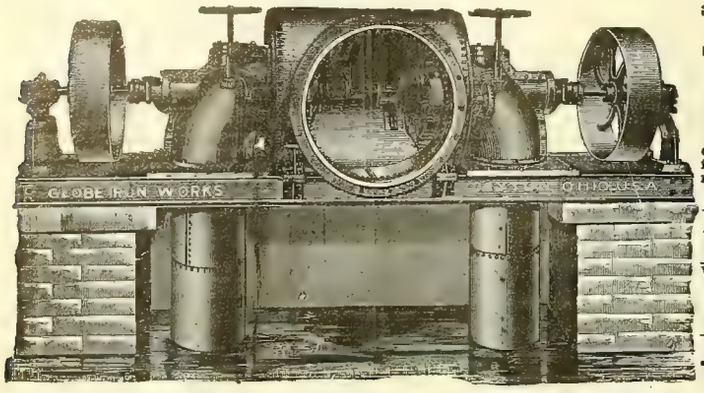


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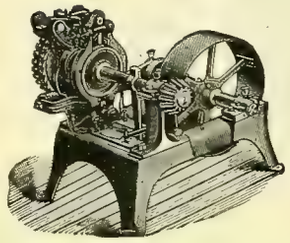

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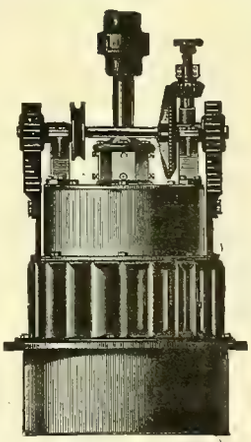

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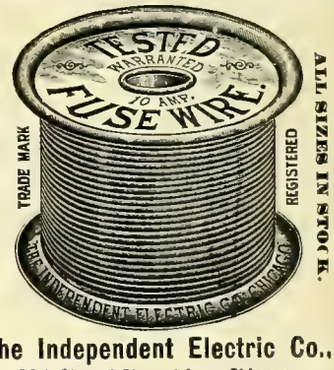


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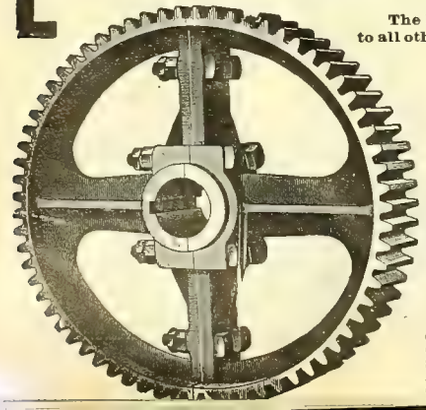

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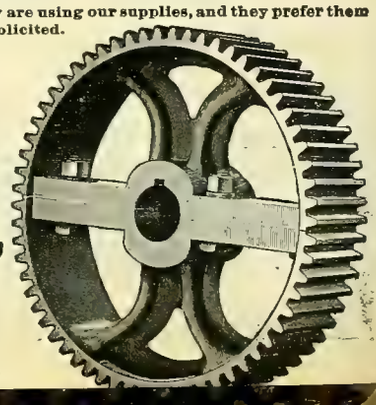

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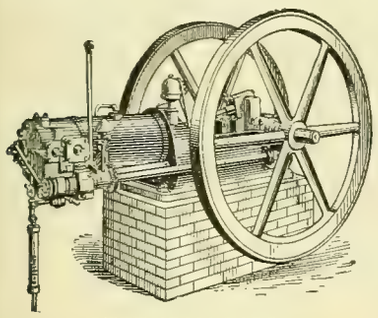

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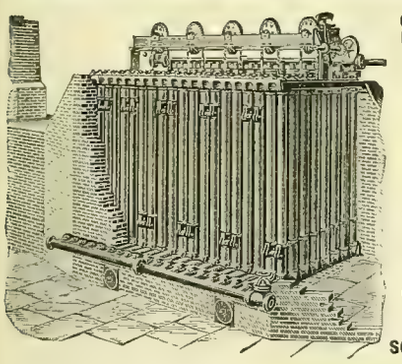

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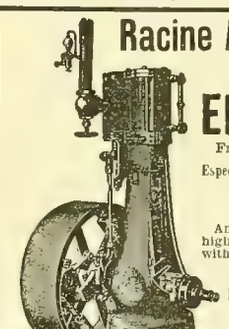

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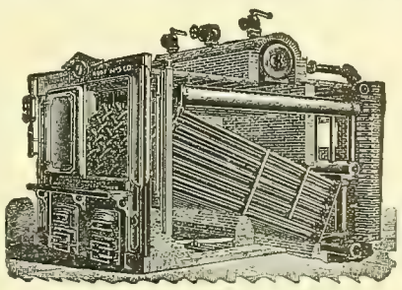

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|---|---|---|---|---|---|---|---|---|---|
| | C. P. | Current. | C. P. | Current. | C. P. | Current. | C. P. | Current. | |
| 21 | 18.0 | 10 | 18.0 | 10 | 15.8 | 10 | 13.2 | 9 | 600 |
| 22 | 16.5 | Lamps. | 17.0 | Lamps. | 14.3 | Lamps. | 8.0 | Lamps. | |
| 23 | 18.6 | 9.99 | 17.5 | 9.97 | 15.2 | 9.99 | 12.4 | 8.83 | |
| 24 | 15.5 | Amperes | 15.2 | Amperes | 13.6 | Amperes | 13.0 | Amperes | |
| 25 | 18.0 | Watts | 18.0 | Watts | 18.3 | Watts | 13.0 | Watts | |
| 26 | 17.5 | per C. P. | 17.5 | per C. P. | 16.0 | per C. P. | 14.4 | per C. P. | |
| 27 | 17.1 | 2.97 | 17.0 | 2.9 | 14.8 | 3.2 | 13.0 | 3.8 | |
| 28 | 15.2 | | 15.8 | | 14.6 | | 12.2 | | |
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| 30 | 16.2 | | 15.5 | | 14.7 | | 13.5 | | |
| Average, | 16.78 | | 16.65 | | 14.86 | | 12.9 | | |

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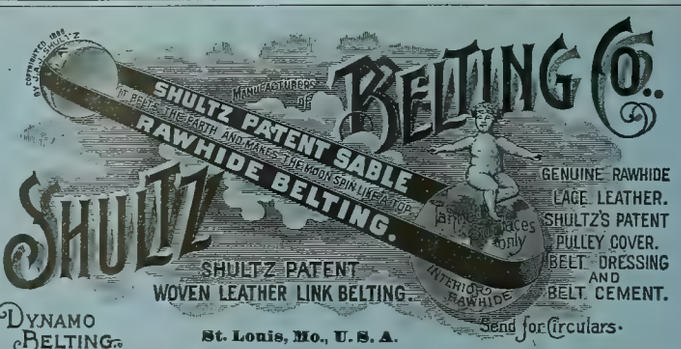


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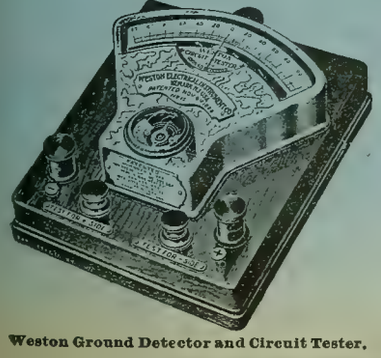

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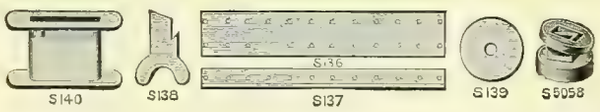


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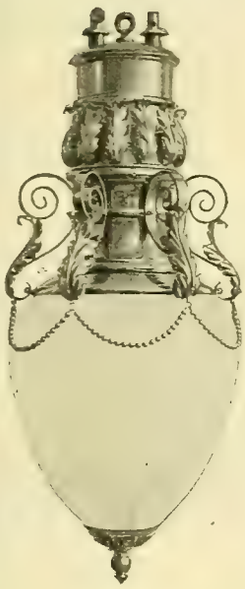

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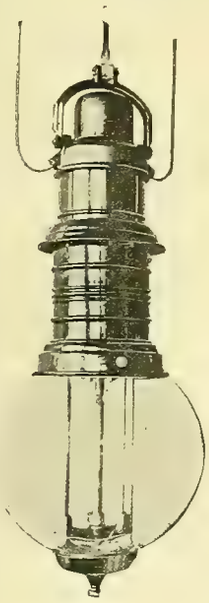

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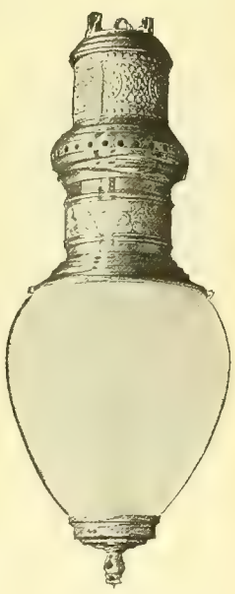

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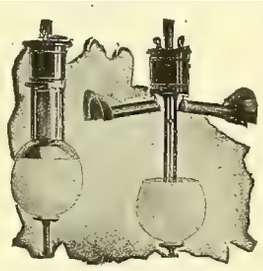

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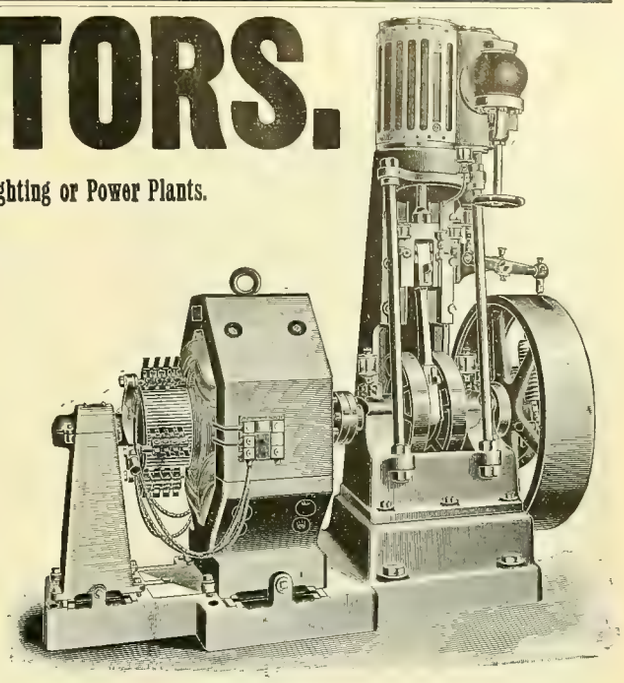

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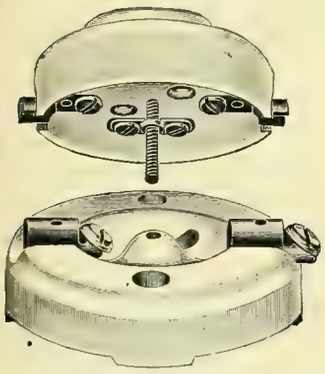

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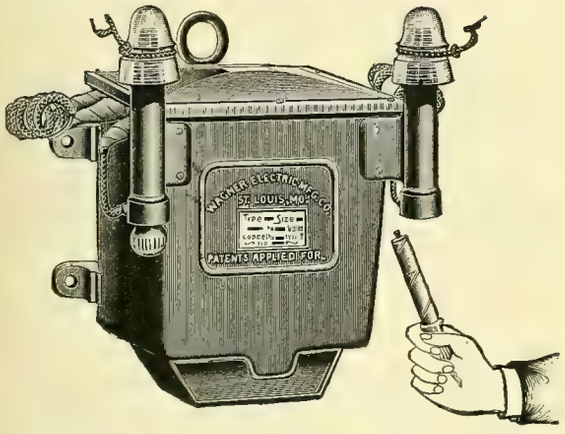


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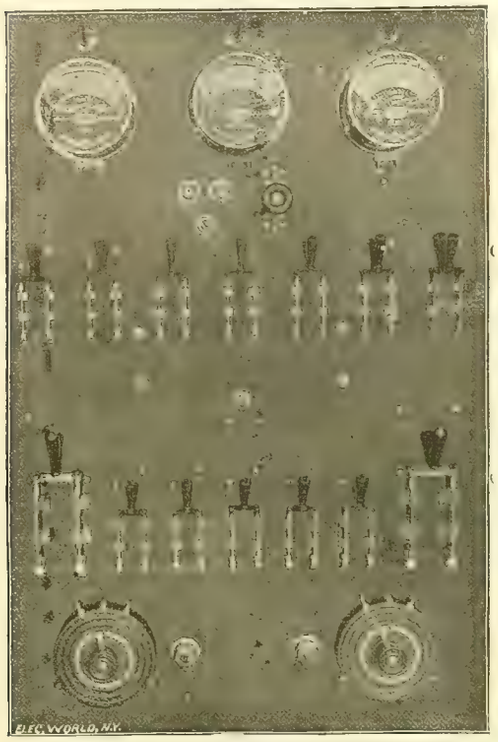

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**AGENTS.**

CENTRAL ELECTRIC CO., Western Agents, Chicago, Ill.
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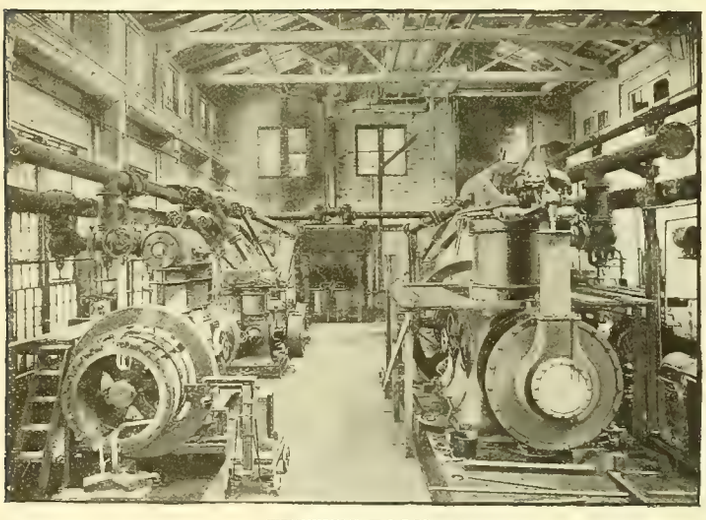
GLOBE ELECTRICAL SUPPLY CONSTRUCTION CO., Agents for New York City and Brooklyn, 98 Vandam St., New York.
W. T. M. MOTTRAM, State Agent, Dallas, Tex.
THE MOUNTAIN ELECTRIC CO., Agents for Colorado, Wyoming, Utah and New Mexico, Denver, Colo.
CALIFORNIA ELECTRICAL WORKS, Pacific Coast Agents, 35 Market St., San Francisco, Cal.
MACHINERY SUPPLY CO., South Pacific Coast Agent, Los Angeles, Cal.
SCHMINKE & NEWMAN Agents for Louisiana and Mississippi, New Orleans, La.
PADUCAH ELECTRIC CO., State Agents, Paducah, Ky.
ROYAL ELECTRIC CO., Montreal, Canada.

# Something About Westinghouse Engines.



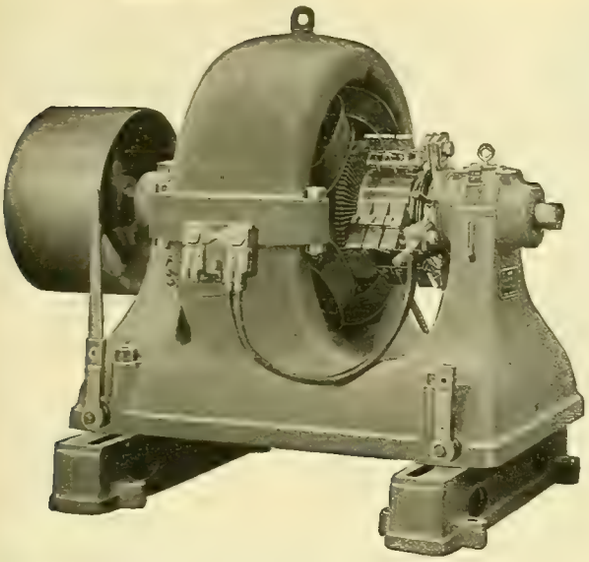
TESTING ROOM.

....TESTING....

Every Westinghouse Engine, from the five horse-power Junior to the seven hundred horse-power Compound, is tested under full load before shipment. Ample facilities for testing the larger sizes of engines will be provided in our new shops, now approaching completion. Our present testing room has accommodations for nine engines at once. The piping is arranged so that the exhaust from any one engine can be turned into a surface condenser, condensed and weighed. The engines are loaded by means of a Prony Friction Brake. Every engine carries its full load from two to four days.

We make running tests on all Junior and Standard engines and economy tests on two engines taken at random from every shop order. We make a careful test of the steam consumption of every Compound engine we build. Reports of these tests with sample indicator cards are on file for every Compound engine ever built by us. This means that when you buy a Westinghouse engine you may be sure it is in perfect running order, its adjustments correct, its internal friction not excessive, and its steam consumption well within the limits of good economy. Further, it means that when we make a guarantee as to the economical performance of our engines, it is not a "bluff," but a fact which may be verified by our records, or by a test which the purchaser is free to make in our shops under the supervision of his own expert, and for which we will gladly furnish every facility. In this respect the Westinghouse Machine Company has no imitators. We cordially invite the most critical inspection of our product and methods of manufacture. Our shops are open at all times to engineers and others interested in steam power. If this subject is of interest we will send you a little circular which explains it more fully.

## THE WESTINGHOUSE MACHINE COMPANY, Pittsburg, Pa., U. S. A.



# The Walker Mfg. Company,

General Offices and Works, CLEVELAND, OHIO.

Manufacturers of all kinds of Electrical Apparatus, specially large size

## GENERATORS,

## Street Railway Motors,

**BRANCH OFFICES:**
913-914 Postal Telegraph Bldg., New York.
195 Crocker Bldg., San Francisco, Cal.
34 York St., Toronto, Ont.
1645-1648 Monadnock Bldg., Chicago.
8 Oliver St., Boston, Mass.,
Erie County Bank Bldg., Buffalo, New York.
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## INCANDESCENT MACHINES,

## ETC., ETC.

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Thousands of our Cells are in Service in U. S. and Abroad.

# STORAGE BATTERIES —FOR ALL PURPOSES.

Solid Rolled Lead Plate. Immense Strength. Large Surface.
Electro-Chemical Formation of Active Material.

INSURING **Greatest Durability** COMBINED WITH **Efficiency.**

ALL SIZES FOR SALE BY

# American Battery Company,

**Established 1889.**
**Highest Award Granted at World's Columbian Exposition, Chicago, 1893.**

42 WEST QUINCY STREET,
CHICAGO, ILL.

**Absolutely Non-Infringing Protection Guaranteed to all Purchasers.**

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Single Pole, Double Pole, 3-Way, 4-Way, anything you may want.

# THE STEVENS FLUSH SWITCH.

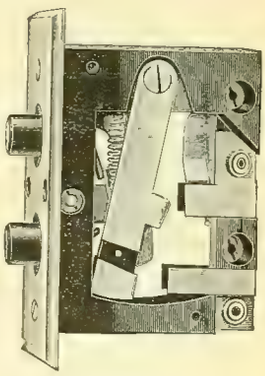
These Switches are second to none. They are fire and damp proof. Mechanism is simplicity itself. Nothing to get out of order. Make and break so wide that no arc can form. Wired without removing casing. Buttons made of mother of pearl. Base made of vulcabeston with porcelain cases.

☞ PARTICULAR ATTENTION IS CALLED TO OUR NEW DOUBLE POLE SWITCH.

Write for price list and discount.

## THE ELECTRIC PROTECTION COMPANY,

MANUFACTURERS,
**1026 Filbert Street, PHILADELPHIA.**



New Double Pole.

---

# BUCKEYE

## INCANDESCENT LAMPS

QUALITY UNEQUALED.

FACTORY PRODUCTION TRIPLED.

Monadnock Building, Chicago. **THE BUCKEYE ELECTRIC CO., Cleveland, O.**

---

# THE CLASS GRADUATES.

It is hoped that thoroughly mastering the four preceding problems may result to our mutual advantage, and we will conclude with a review and one final problem.

## REVIEW.

Example I.—"O. K." weatherproof versus cheap line wire.
Example II.—The Packard Transformer versus the "Nondescript."
Example III.—The Packard Lamp versus the "advertised cheap" lamp.
Example IV.—Paranite Wire versus reclaimed rubber insulations(old rubber boots and shoes).

## FINAL EXAMPLE NUMBER V.

The serviceability of an Arc Lamp does not depend upon the extensiveness and intricacy of interior mechanism, nor yet upon the frills and furbelows of the exterior design. Some manufacturers depend upon one or both of these to sell their goods.

The Upton Arc Lamp is sold on the basis of its utility for the work for which it is made, the simplicity of its mechanism and its business-like appearance. Where we can get them in on trial we depend entirely on their readily apparent merit.

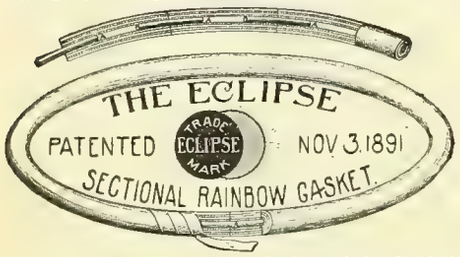
**Q. E. D.**

BUY THE UPTON ARC LAMP.

## Electric Appliance Company,

THE UPTON ARC LAMP. **ELECTRICAL SUPPLIES.** 242 MADISON ST., CHICAGO.

# WHY BE A FOGY?

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3/8 in. for **UNIONS.**

1/2 in. for **HAND-HOLES.**

5/8 in. for **MAN-HOLES.**

Put up in boxes, weight 3 to 6 lbs.

Patented and Manufactured exclusively by

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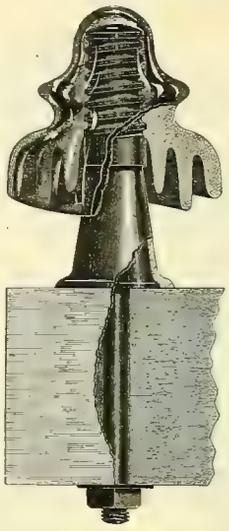


THE

# Highest Insulation

IN

## Triple Petticoat China and Glass Insulators...

SEND FOR CATALOGUE.

# Fred M. Locke,

VICTOR, N. Y.

A NEW CIRCULAR describing the **Hoyt Station Ammeters** AND **Voltmeters** sent free on application.

WHITNEY ELECTRICAL INSTRUMENT CO., Penacook, N. H., U. S. A.

ESTABLISHED 1857.

**WALLACE BARNES,**

*Manufacturer of*

FLAT, COILED AND WIRE

**STEEL SPRINGS**

OF EVERY DESCRIPTION

Send sample for prices. **Bristol, Conn.**

SEND FOR SAMPLES AND PRICES OF

**SAMSON SPOT CORD**

For Arc Light and Trolley Cord.

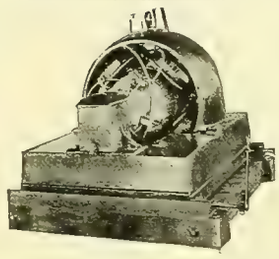
SAMSON CORDAGE WORKS, - BOSTON, MASS.

# CARD

Generators for Power Transmission or Isolated Lighting.

CARD Generators are all Multipolar and Slow Speed.

AGENTS WANTED IN UNOCCUPIED TERRITORY.



75 K. W. GENERATOR.

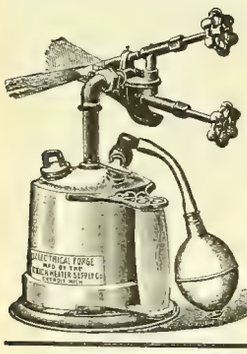
# CARD

Multipolar Slow Speed Stationary Motors.

Reversible Motors and Controllers for Rolling Mills, Bridges and Traveling Cranes.

**THE CARD ELECTRIC COMPANY,**

Office and Works, Mansfield, Ohio.



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ELECTRICIANS, CYCLE MAKERS AND ENGINEERS.

Nothing better for wire soldering. Where once used it is indispensable.

**The Flames are Strong Enough to Melt Copper.**

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92 Congress St., East DETROIT, MICH.

Agents wanted in leading cities. Samples sent on approval to responsible parties.

YOUNGLOVE & GERE, Syracuse, N. Y.

# HART FLUSH SWITCH.

Solid Face Plate, Beveled Edges.

**All Sizes of Hart Switches.**

GANG PLATES FOR ANY NUMBER.

Self-Adjusting Handle.

NO BREAKAGE.

Always the Right Pressure on Face Plate.

## HART & HEGEMAN MFG. CO.,

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THE MOST DESIRABLE

# GARLOCK'S

(PATENTED.)

## HIGH GRADE PACKINGS

FOR STEAM, WATER, GAS, AMMONIA, ETC.

TRADE GARLOCK MARK

GARLOCK'S WATER-PROOF HYDRAULIC PACKING.

ECONOMICAL, RELIABLE, DURABLE & GUARANTEED.

NONE GENUINE WITHOUT THIS TRADE MARK

**THE GARLOCK PACKING CO.**

NEW YORK, BOSTON, PHILADELPHIA, CHICAGO, PITTSBURGH, ST. LOUIS, OMAHA. (Factories & Main Offices) PALMYRA, N.Y. ROME, GA.

SEND FOR CATALOGUE & PRICES.

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(ELECTRIC BRAND)

## For Electrical Purposes

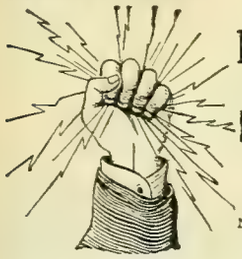
Guaranteed 98/99% and free of lead and iron. If you want the best quality ask your dealer for this brand. Imported by

**A. KLIPSTEIN & COMPANY, 122 Pearl St., New York.**

EUGENE F. PHILLIPS, Prest. W. A. HATHAWAY, Treas. W. H. SAWYER, Secy.

# AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.



BARE AND INSULATED ELECTRIC WIRE,

ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,

Railway Feeder and Trolley Wire,

AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.

CABLES FOR AERIAL AND UNDERGROUND USE.

NEW YORK STORE, P. C. Ackerman, 10 Cortlandt St.
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MONTREAL BRANCH. Eugene F. Phillips' Electrical Works.

# IRON ARMORED INSULATING CONDUITS.

Two Wires in a Single Tube, the Standard Method of Electric Wiring.

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Edwd. H. Johnson, Prest. E. W. Little, Vice-Prest. and Gen. Mgr. Chas. P. Geddes, Sec'y and Treas.

THE

# "CLARK" WIRE.

TRADE MARK.

For Switchboard, Railway and Motor use, we make all sizes of Stranded and Flexible Wire and Cables with Clark's Insulation.

The Clark Wire has been before the public and in use for the past nine years, and has met with universal favor. Thousands of miles of this wire have been sold, and are in use throughout the United States and Foreign Countries, and the demand for it is constantly increasing, because it always gives perfect satisfaction.

BRANCH OFFICE:

1649, 1650, 1651 MONADNOCK BLDG.,
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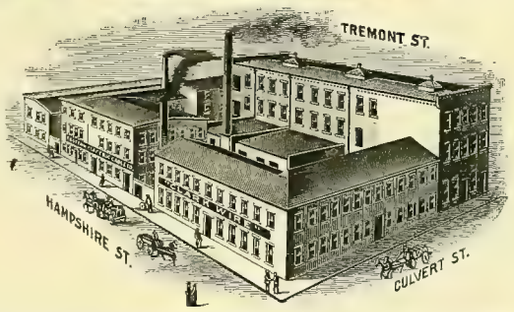


In a Letter from the Inspector of the Boston Fire Underwriters' Union, he states: "A Thoroughly Reliable and Desirable Wire in every respect."

The Rubber used in insulating our Wires and Cables is especially chemically prepared, and will not deteriorate, oxidize or crack, and will remain flexible in extreme cold weather, and is not affected by heat.

We guarantee our Insulation wherever used, Aerial, Underground or Submarine, and our net prices are as low, if not lower, than any other first-class Insulated Wire.

We shall be pleased to mail Catalogues with Terms and Discounts for Quantities.

## EASTERN ELECTRIC CABLE CO.,

61 and 63 Hampshire St., Boston, Mass.

HENRY A. CLARK, Treas. and Gen'l Mgr. HERBERT H. EUSTIS, Prest. and Electrician.

The Best on the market.
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Empire China Works.
144-156 GREENE ST. STATION G.
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GENUINE HARD PORCELAIN, CUT-OUTS, SWITCH BASES, INSULATORS &c.

# Subscribe for the Western Electrician.

GENERATOR AND MOTOR

## COMMUTATORS

MADE NEW, AND OLD SHELLS REFILLED.

EVERY SYSTEM.

We Repair Old Commutators.

F. E. HOMER & CO., Cleveland, O.

## COMMUTATORS REFILLED.

Sioux City Brass Works,
SIOUX CITY, IOWA.


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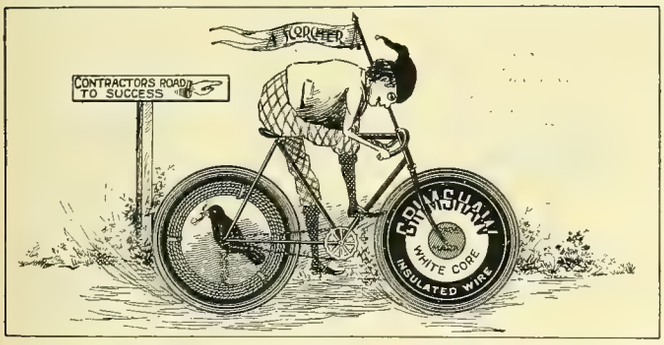
Only $18.00 to New York City and return via the Nickel Plate Road. Trains leave Chicago at 1:30 P. M. and 9:20 P.M. on Monday, Dec. 2d, 1895. No time in the year may a visit to the Metropolis be made to better advantage. All amusements at high tide and no discomforts incident to hot weather. Sleeping cars and day coaches through without change. Tickets and berths in sleeping cars may be secured in advance at 111 Adams St., Chicago, Ill. Memo. No. 104.


# GRAPHITE SPECIALTIES

FOR ELECTRICAL USES:

Graphite Rods of Various Lengths, from 1-5 Ohm to 100 Ohms Resistance to the inch. Graphite Boxes and Crucibles, Resisting Heats of 4,000 Degrees. Inquiries Gladly Answered.

JOS. DIXON CRUCIBLE CO., Jersey City, N. J.




GRIMSHAW WHITE CORE. Used exclusively for all Incandescent Lighting at World's Columbian Exposition.

RAVEN WHITE CORE. Used in some of the largest buildings in the United States.

COMPETITION LINE WIRE. Used by some of the largest Central Stations and Fire and Police Departments in the U.S.

GRIMSHAW TAPES, COMPETITION TAPES AND SPLICING COMPOUNDS.

## New York Insulated Wire Company,

MAIN OFFICE: 13-17 Cortlandt St., New York.

BRANCHES: CHICAGO: 320 Dearborn St. BOSTON: 134 Congress St. SAN FRANCISCO: 102 Sacramento St

# ELECTRICAL SUPPLIES.

## WESTERN ELECTRIC COMPANY,

CHICAGO. NEW YORK.

AGENCIES:

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PETTINGELL-ANDREWS CO., BOSTON, MASS.
ELECTRICAL ENGINEERING CO., MINNEAPOLIS, MINN.
ST. LOUIS ELECT'L SUPPLY CO., ST LOUIS, MO.
BRADFORD BELTING CO., CINCINNATI, OHIO.

# Phillips Insulated Wire Co.,

NEW YORK OFFICE: 39 and 41 Cortlandt St.

FACTORY: Pawtucket, R. I.

## WANTED.

A competent man to act as foreman of armature department. None but first-class men need apply. Give experience and class of work you have done. Apply

CANADIAN GENERAL ELECTRIC CO.,
Peterboro, Ont

## WANTED.

Competent wireman, dynamo tender and central station man. Steady work for right man. Address, stating experience and references,

TAGONA WATER & LIGHT CO.,
Sault Ste. Marie, Ontario.

## WANTED.

Position in an electrical repair shop or on a construction gang. Am a High School graduate and have had considerable experience in a repair shop. Address

"Repair Man,"
Care of WESTERN ELECTRICIAN.

## FOR SALE.

Small lot of American Gas Engine Electric Co.'s stock, cheap. Address

"C. E. R.,"
Care of WESTERN ELECTRICIAN,
Chicago.

# FOR SALE.

The plant of the MATHER ELECTRIC CO., located at South Manchester, Conn. This plant has all the modern appliances for doing first-class work, is well equipped and will be sold at a bargain.

Apply to CHAS. M. JARVIS, Receiver, EAST BERLIN, CONN.

## INSOLVENT NOTICE.

In the matter of
LA CIE ELECTRIQUE ST JEAN-BAPTISTE
Of the City of Montreal, Canada, P. Q
In Liquidation.

The undersigned will sell by public auction, in three lots, at the office of Chas. Desmarteau, Liquidator, No. 1598 Notre-Dame St., Montreal, Canada, P. Q., on

*Thursday, the 19th of December 1895, at eleven o'clock in the forenoon,*

All the immovable properties and movable assets of the said company, consisting of:

1. All those tracts and parcels of land situated in St. Jean Baptiste Ward, in the City of Montreal, Province of Quebec, Dominion of Canada, described as follows:

*A.* The northeasterly parts of lots numbers 32 (thirty-two), 33 (thirty-three) and 34 (thirty-four), according to the official subdivision of lot number 10 (ten), of the official cadastre, of the village of St. Jean Baptiste, comprising an area of 4,970 (four thousand nine hundred and seventy) feet, more or less; and bounded toward the northeast by Montana Street, toward the southeast by Rachel Street, toward the northwest by lot number thirty-five of said official subdivision of said lot number ten, and toward the southwest by the remaining parts of said lots numbers thirty-two, thirty-three and thirty-four of said official subdivision of said lot number ten, with buildings and dependencies thereon erected.

*B.* Lots numbers 35 (thirty-five), 36 (thirty-six), 37 (thirty-seven), 38 (thirty-eight), 39 (thirty-nine), 40 (forty), 41 (forty-one) and 42 (forty-two) of said official subdivision of said lot number 10 (ten), comprising an area of 17,296 (seventeen thousand two hundred and ninety-six) feet, more or less; bounded toward the northeast by Montana Street, toward the southwest by lot number sixty-one (*a*) of said subdivision of lot number ten, toward the northwest by lot number forty-three, and toward the southeast by lot number thirty-four of said subdivision of said lot number ten, together with the right of passage in common with adjoining proprietors in the lane at the rear of said lots.

*C.* All engines, boilers, dynamos, tank (15 000 gallons), machinery, belting, shafts and general plant used for manufacturing and generating electricity, as well as the wires and posts, transmitters, meters, lamps etc., used for distributing and furnishing electric light to the citizens of Montreal and suburbs; the material and stock used for repairing the lines of the company, the whole amounting as per inventory to one hundred and forty-four thousand three hundred and seventy-one dollars ($144,371.00).

*D.* The franchise rights and privileges acquired by said company to plant poles in the streets of the City of Montreal.

2. The office furniture and fixtures, etc., amounting to $196 00.

3. The book debts amounting, as per list, to $3,456.00.

The purchaser of the immovable and dependencies described in paragraph 1 shall have to make a cash deposit of five thousand dollars currency ($5,000) at the time of adjudication.

The purchasers of movable assets described in paragraphs 2 and 3 shall have to make a cash deposit of ten per cent. at the time of adjudication.

For further information apply to
CHAS. DESMARTEAU, Liquidator,
1598 Notre-Dame St.,
Montreal,
Canada, P. Q.

Marcotte Frère,
Auctioneers,

## FOR SALE CHEAP.

7½ H. P, 500 Volt C. & C. Motor, 3 H. P. 500 Volt Crocker-Wheeler Motor, and other second-hand machines.

E. R. HARDING,
1540 MARQUETTE BLDG., - CHICAGO.

POSITIVELY
The Best Made and Finest Finished Desk on the market for the money. Write for Catalog.
Ithaca Desk Co., Ithaca, N.Y.
$22

## KESTER ELECTRIC MFG. CO.,

640 Linwood Ave., Buffalo, N. Y.
MANUFACTURERS OF THE
Niagara Electric Battery,
Kester's Soldering Compound,
Kester's Commutator Compound,
Kester's Self Lubricating Dynamo and Motor Brushes.

## WIRT BRUSHES

Are made only by
Charles Wirt, 1026 Filbert, Philadelphia.
For Sale by the Trade.
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## CONDUITS.

In lengths of 4 ft. 6 in., any number of ducts.

Are you interested in Conduits? If you are it will pay you to look into the merits of the latest — undoubtedly the best.

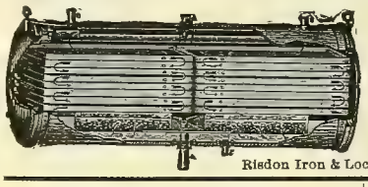
JOHN T. McROY,
36 S. Clark Street, Chicago.

# FOR SALE, CHEAP!
## NEW 50 LIGHT
# Arc Dynamo.

This machine has never been used. In fact, has not yet been taken out of shop. Is of leading manufacture and will be guaranteed direct to purchaser by makers. Will be sold for one hundred dollars under market for cash.

Address DYNAMO,
WESTERN ELECTRICIAN OFFICE.

# Stilwell's Patent Live Steam-Feed Water Purifier.



Removes all Impurities.

Entirely prevents *scale* in Steam Boilers. Catalogue on application.

The Stilwell-Bierce & Smith-Vaile Co.,
DAYTON, OHIO.

Risdon Iron & Loc'tive W'ks, S n Francisco, Cal., Pacific Coast Agt

## C. S. HART,

WHOLESALE
Telegraph, Telephone, Electric Light
AND STREET RAILWAY POLES.
Manufactured from Live Cedar peeled. Quick shipments and best quality.
OCONTO, WIS.

## A. L. LEWIS,

Wholesale Producer of and Dealer in
CEDAR POLES AND TIES.
FROM THE STUMP TO THE CONSUMER.
Write for Prices.
Menominee, - - Michigan.

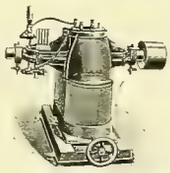
## THE TELEPHONE HAND-BOOK.

BY
HERBERT LAWS WEBB

*Price $1.00.*

The only complete and practical work of its kind on the market.

PUBLISHED BY
THE ELECTRICIAN PUBLISHING CO.,
61 Lakeside Building, Chicago.



Dynamos, Electric Motors,
Manufactured by
ROTH BROS. & CO.,
30 to 34 Market St.,
Chicago, Ill.
High Efficiency,
Perfect Regulation,
Best Material,
Low Prices,
Complete Plants Installed.

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*Mechanical and Architectural Drawing, Steam Engineering (Stationary, Marine, Locomotive), Plumbing, Heating, Civil Engineering, Coal and Metal Mining, English Branches,*

TAUGHT BY MAIL.

Twenty-seven Courses of Study. Send for *free* circular. State subject you wish to study,
The International Correspondence Schools,
SCRANTON, PA.

## INDIA AND AMBER MICA.

Can furnish any size, shape or pattern. Write for samples and quotations.
A. O. SCHOONMAKER, Importer,
158 William St. New York.

# WE REWIND
## *Dynamos and Motors*

To any Voltage.

Send your Machines to us for Repairs.
PROMPT AND EFFICIENT WORK GUARANTEED.

## Hartley Electrical Works,

REPAIRERS OF
Electrical Apparatus
AND DEALERS IN
*Second Hand Dynamos, Motors and Transformers,*
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Telephone, Main 1096.

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196 and 198 Clark Street, Chicago.
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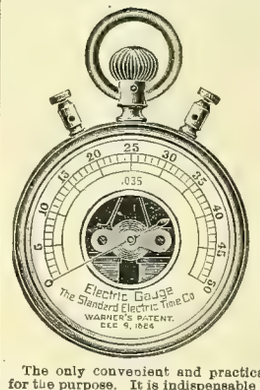


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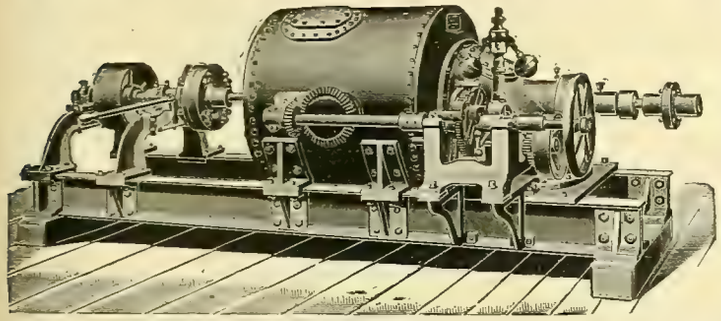

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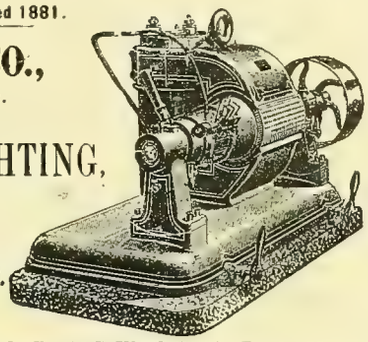

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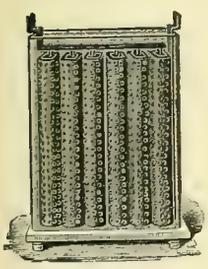

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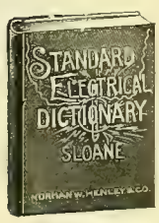


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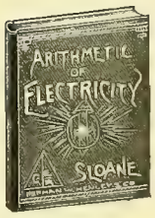


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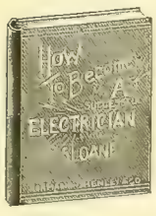


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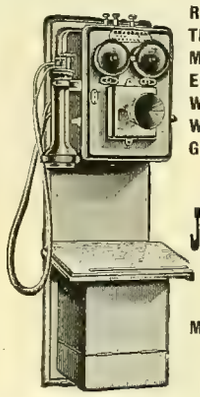

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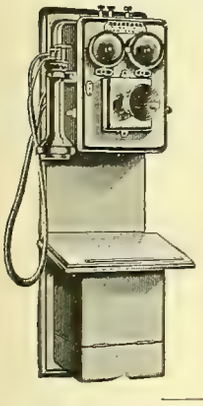

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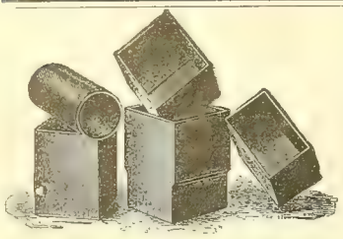

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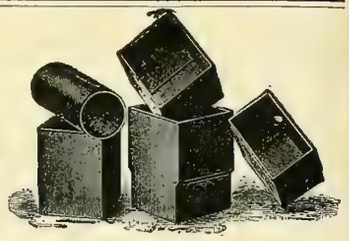

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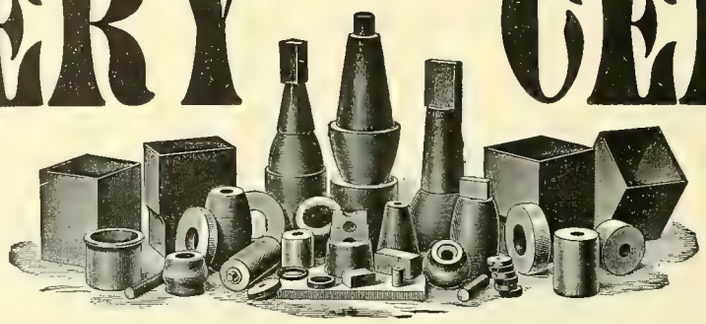

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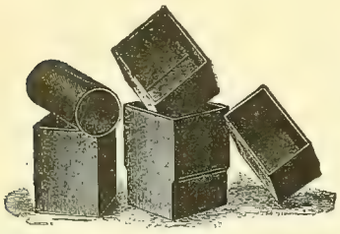

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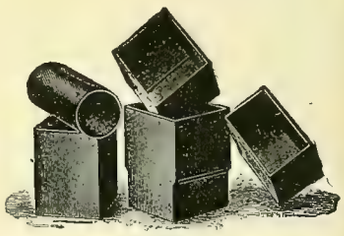

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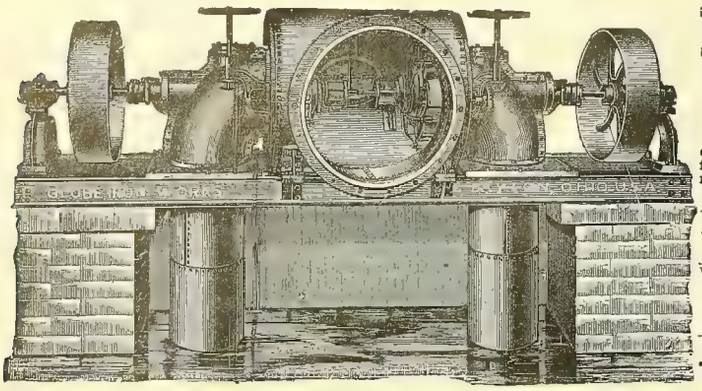

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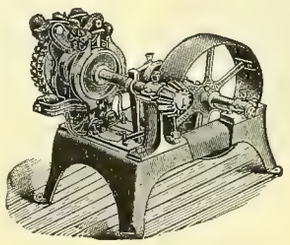

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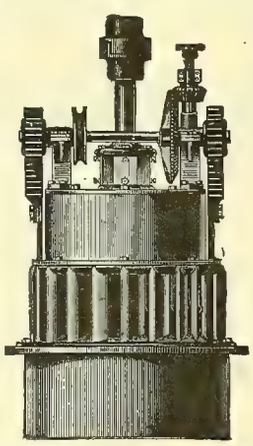

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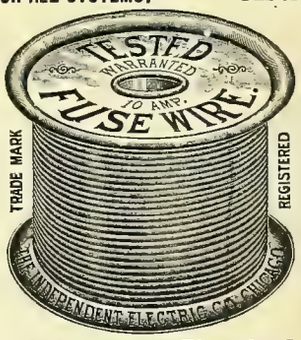


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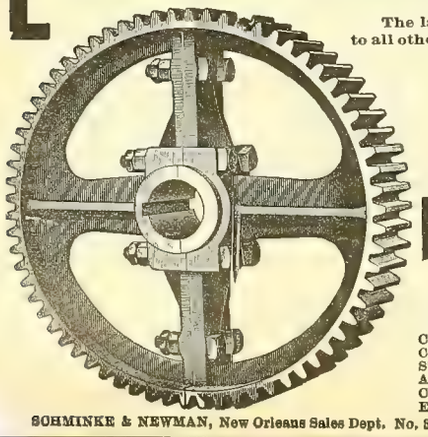

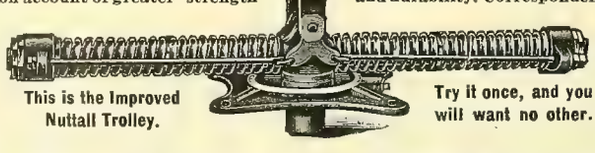

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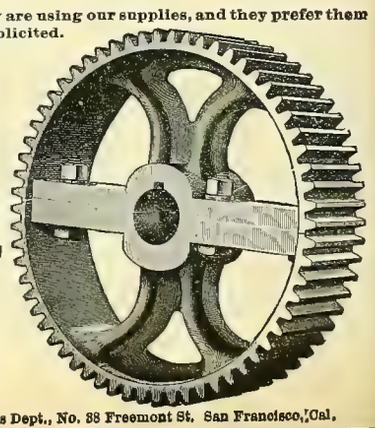

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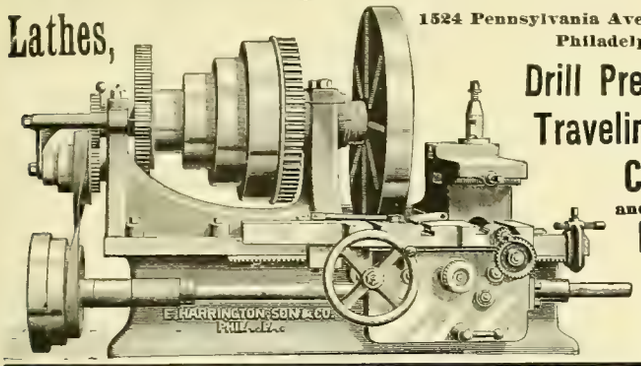


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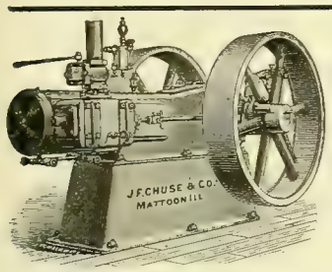


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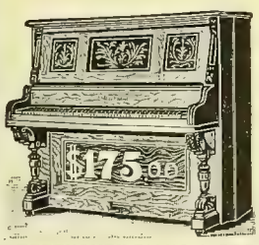


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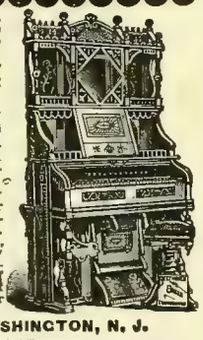

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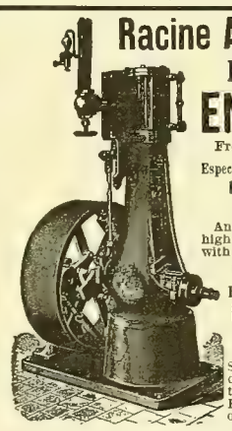

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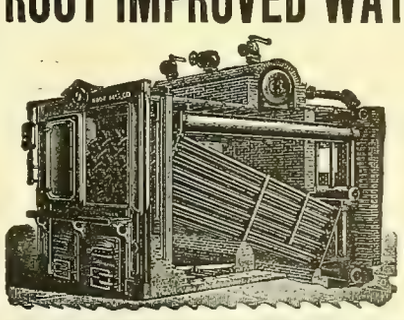

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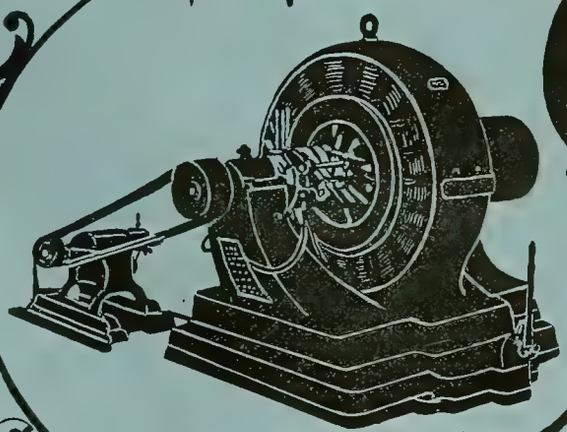

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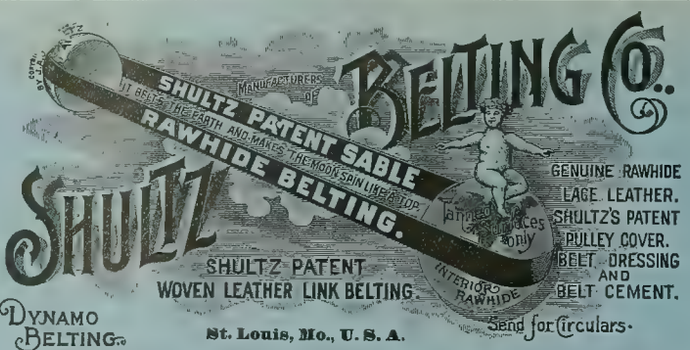


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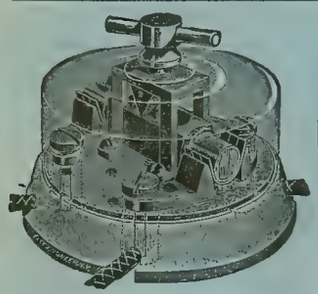

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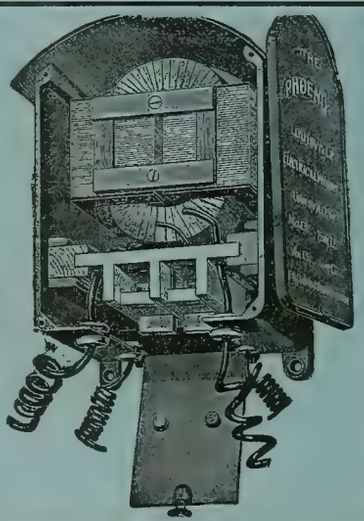

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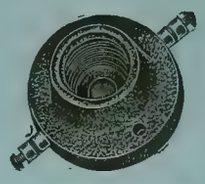

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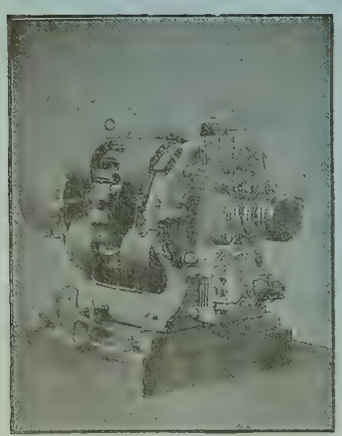

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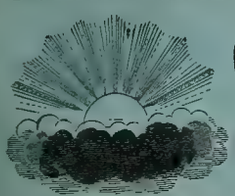

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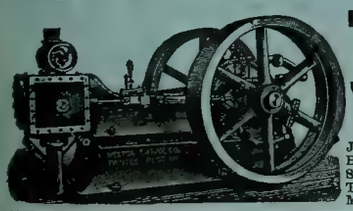

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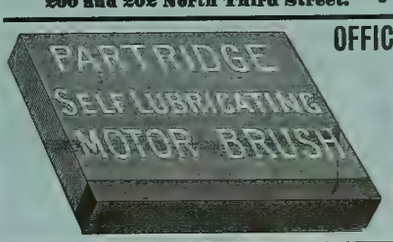


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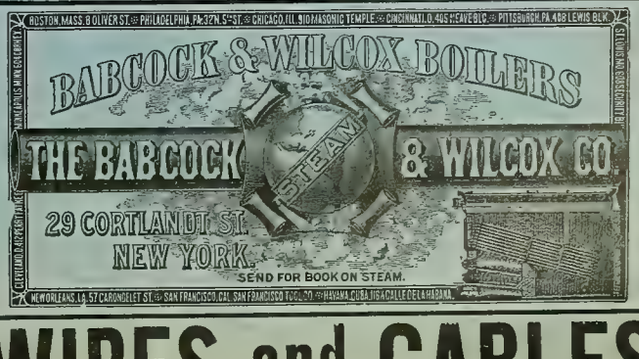


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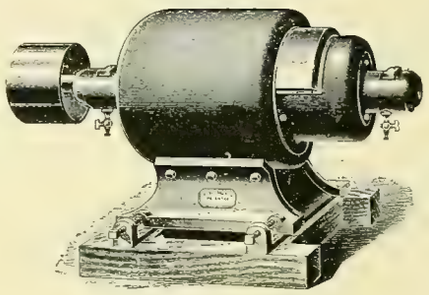

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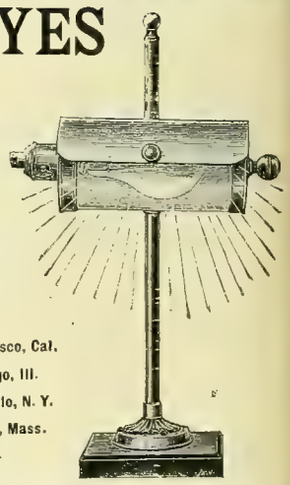

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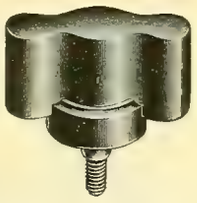

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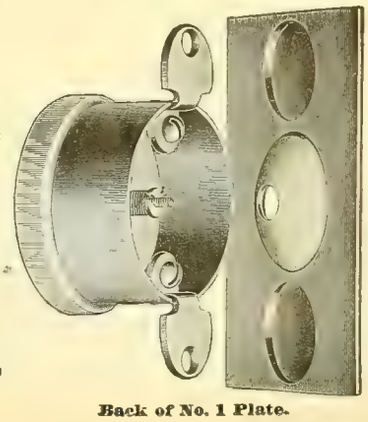

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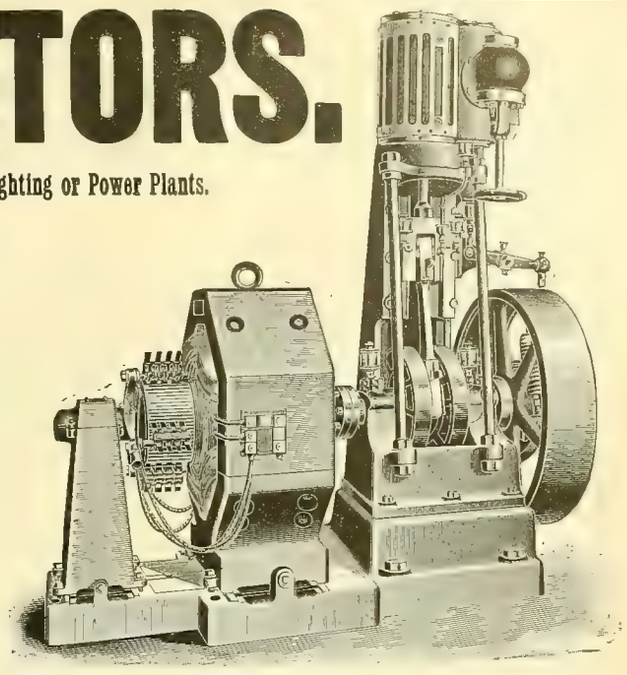

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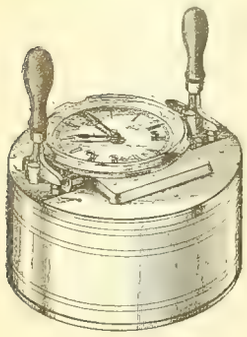

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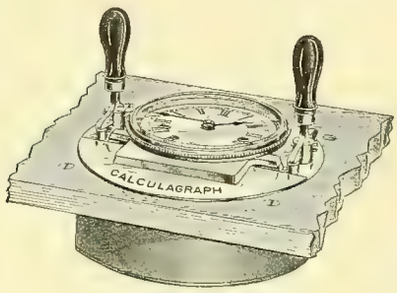


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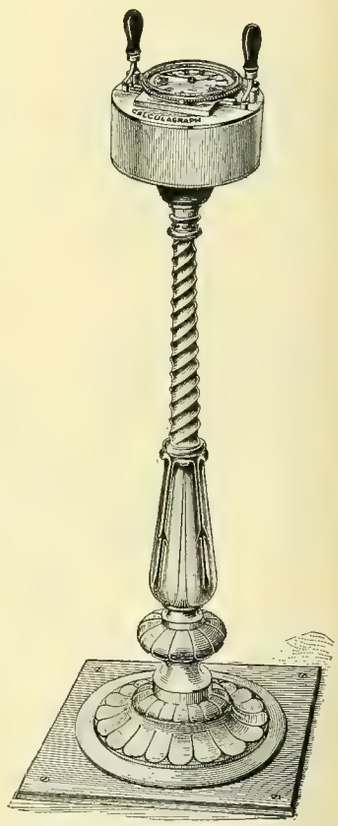


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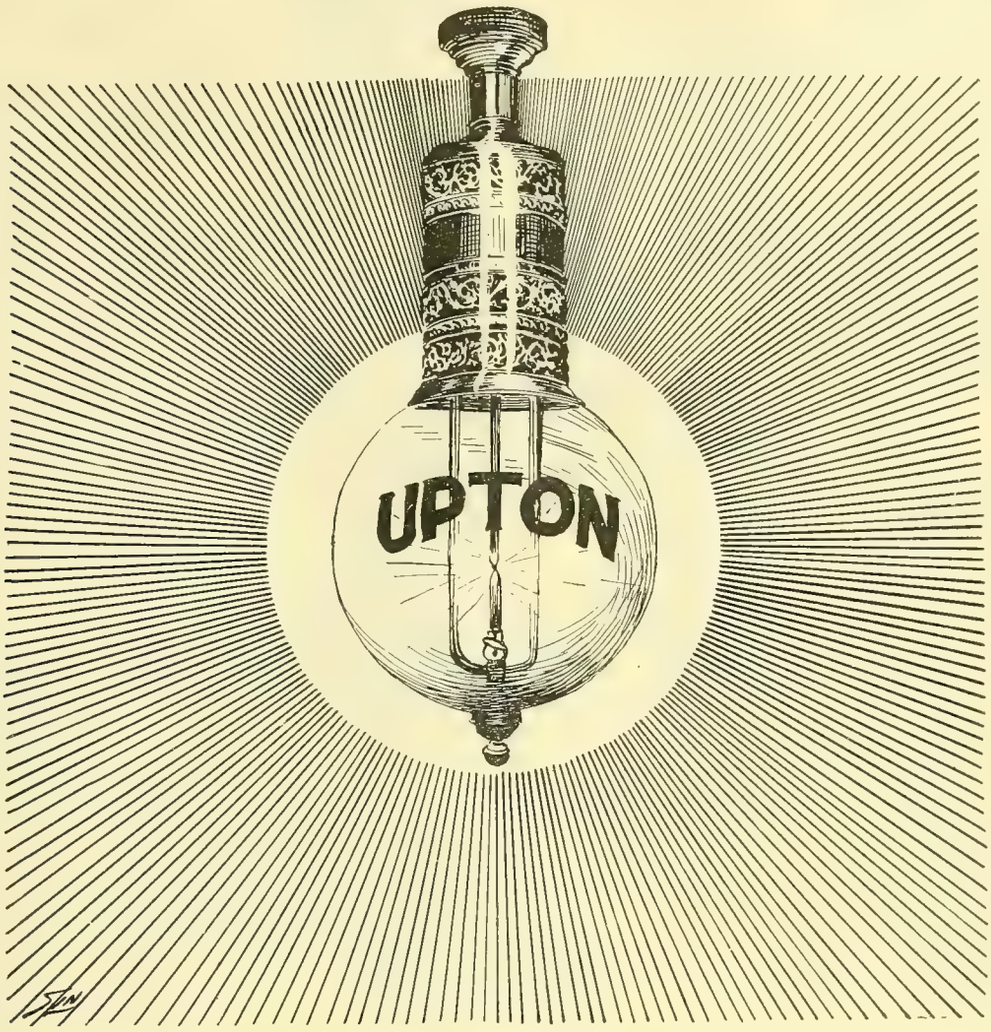


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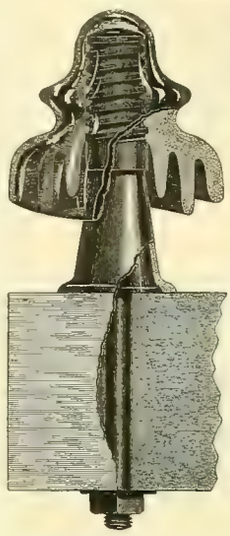
A NEW CIRCULAR describing the
**Hoyt Station Ammeters and Voltmeters**
sent free on application.
WHITNEY ELECTRICAL INSTRUMENT CO.,
Penacook, N. H., U. S. A.

**F. M. BERNARDIN...**
**Electric Railway Supplies, Poles and Ties.**
KANSAS CITY, MO.

SEND FOR SAMPLES AND PRICES OF
**SAMSON SPOT CORD**

For Arc Light and Trolley Cord.
SAMSON CORDAGE WORKS, - BOSTON, MASS.



THE
# Highest Insulation
IN
## Triple Petticoat China and Glass Insulators...
SEND FOR CATALOGUE.

# Fred M. Locke,
VICTOR, N. Y.

The Highest Standard of Excellence.
ORIGINAL
## Laclede and Hercules Batteries,
MADE ONLY BY THE
## PERU ELECTRIC MFG. CO.,
PERU, IND.
Also Manufacturers of all kinds of Electric Porcelain.

¼ to 2 inch diameter. In Boxes 3 to 8 lbs.

—THE—
## PEERLESS SPIRAL Piston and Valve Rod PACKING
Expressly for High Speed Engines. Will Hold 400 lbs. Steam.
20 YEARS OLD AND NO EQUAL.
Manufactured Exclusively by
## PEERLESS RUBBER MFG. CO.
970 Old Colony Bldg., Chicago, Ill.
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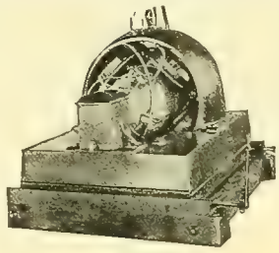
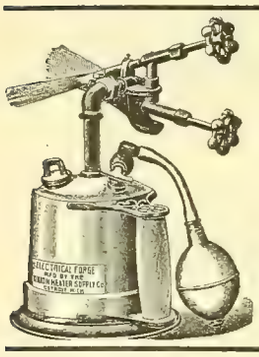
# CARD
Generators for Power Transmission or Isolated Lighting.
CARD Generators are all Multipolar and Slow Speed.
AGENTS WANTED IN UNOCCUPIED TERRITORY.



75 K. W. GENERATOR.

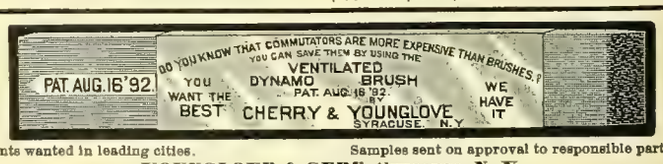
# CARD
Multipolar Slow Speed Stationary Motors.
Reversible Motors and Controllers for Rolling Mills, Bridges and Traveling Cranes.
THE CARD ELECTRIC COMPANY,
Office and Works, Mansfield, Ohio.



# ELECTRICAL FORGES
FOR
ELECTRICIANS, CYCLE MAKERS AND ENGINEERS.
Nothing better for wire soldering. Where once used it is indispensable.
The Flames are Strong Enough to Melt Copper.
## UNION HEATER SUPPLY CO.,
92 Congress St., East DETROIT, MICH.

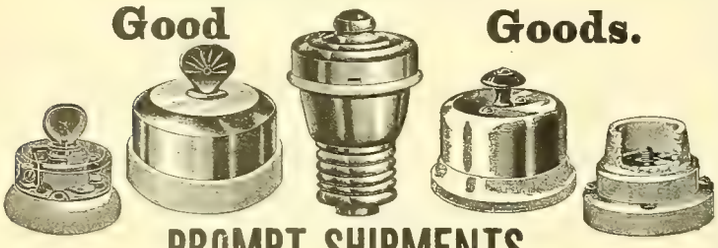
**KESTER ELECTRIC MFG. CO.,**
640 Linwood Ave., Buffalo, N. Y.
MANUFACTURERS OF THE
Niagara Electric Battery,
Kester's Soldering Compound,
Kester's Commutator Compound,
Kester's Self Lubricating Dynamo and Motor Brushes.

ESTABLISHED 1857.
**WALLACE BARNES,**
*Manufacturer of*
FLAT, COILED AND WIRE
## STEEL SPRINGS
OF EVERY DESCRIPTION
Send sample for prices. Bristol, Conn




Agents wanted in leading cities. Samples sent on approval to responsible parties.
YOUNGLOVE & GERE, Syracuse, N. Y.

# Bryant Electric Company,
BRIDGEPORT, CONN., AND CHICAGO.
Good Goods.



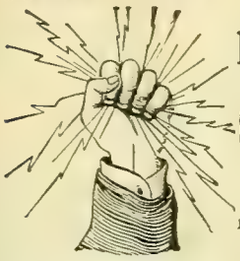
## PROMPT SHIPMENTS.
GRIER BROTHERS, { Thos. G. Grier, Edward B. Grier, } Managers Western Office.
*Monadnock Bldg., Chicago.*
☞ The R. Thomas & Sons Co. Porcelain is Good.

## CROUSE=TREMAINE
Commercial Electrical Supply Co.,
AGENTS,
821 Pine Street, - ST. LOUIS.
## CORED==CARBONS

EUGENE F. PHILLIPS, Prest. W. A. HATHAWAY, Treas. W. H. SAWYER, Secy.

# AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.



BARE AND INSULATED ELECTRIC WIRE,

ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,

Railway Feeder and Trolley Wire,

AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.

CABLES FOR AERIAL AND UNDERGROUND USE.

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MONTREAL BRANCH Eugene F. Phillips' Electrical Works.

# IRON ARMORED INSULATING CONDUITS.

Two Wires in a Single Tube, the Standard Method of Electric Wiring.

## INTERIOR CONDUIT & INSULATION CO.,

General Offices and Works: 527 W. 34th St., New York.

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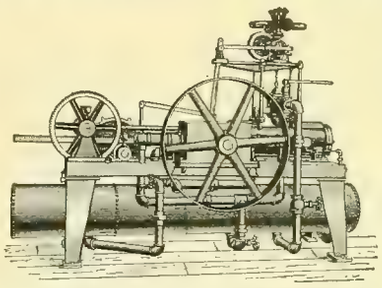
# The Only Water-Wheel Governor that Governs.

*Montague Street Railway Co.*
GREENFIELD, MASS., Sept. 19, 1895.

Lombard Water-Wheel Governor Co., 61 Hampshire St., Boston, Mass.

GENTLEMEN:—We have one of your Governors in use at our power house at Millers Falls, Mass., taking care of two water-wheels to perfection, regulating the power *within a few volts.* We took out one Governor and replaced it with a LOMBARD GOVERNOR which gives *perfect satisfaction.* Yours truly, MONTAGUE ST. RY. CO.,
(Signed) H. C. GARFIELD, Supt.



Sold on trial and absolutely guaranteed to hold wheel speed to satisfaction of purchaser, irrespective of sudden changes of load.

Send us a description of your water-wheel plant.

LOMBARD WATER-WHEEL GOVERNOR CO.,

61 HAMPSHIRE STREET, BOSTON, MASS.

The Best on the market.
MacCurdy & Smith, Indianapolis, Ind.

The Brady Mast Arms.

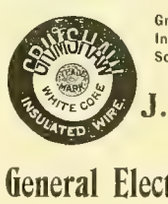
T. H. Brady, New Britain, Conn., U. S. A.,

Manufacturer of Mast Arms, Pole and Swinging Hoods, House Brackets and other Specialties for Construction Work. — *Catalogues and Prices furnished on application.*

## CROSS ARMS, PINS AND BRACKETS.

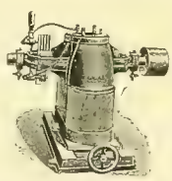
Why not use Yellow Pine Cross Arms?
We also manufacture Oak Pins and Brackets, and GENUINE BLACK LOCUST PINS.
We can ship promptly.
We guarantee our product equal to any in the market.
Correspondence solicited.

CENTRAL MANUFACTURING COMPANY, Chattanooga, Tenn.




Grimshaw Wires and Cables, Incandescent Lamps, Sockets, Switches, Etc.

J. W. MASON,
DEALER IN
General Electrical Supplies,
KANSAS CITY, MO.



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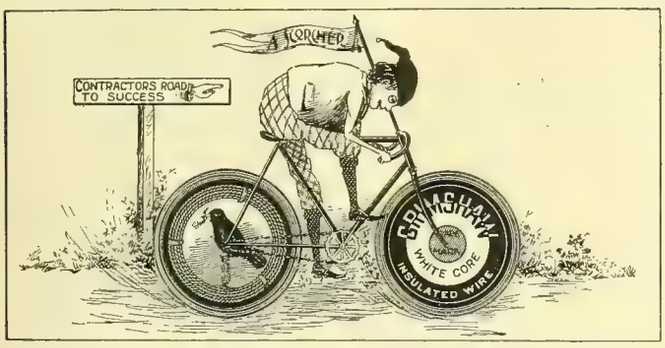
ROTH BROS. & CO.,
30 to 34 Market St., Chicago, Ill.
High Efficiency, Perfect Regulation, Best Material, Low Prices, Complete Plants Installed.




GRIMSHAW WHITE CORE. Used exclusively for all Incandescent Lighting at World's Columbian Exposition.

RAVEN WHITE CORE. Used in some of the largest buildings in the United States.

COMPETITION LINE WIRE. Used by some of the largest Central Stations and Fire and Police Departments in the U.S.

GRIMSHAW TAPES, COMPETITION TAPES AND SPLICING COMPOUNDS.

## New York Insulated Wire Company,

MAIN OFFICE: 13-17 Cortlandt St., New York.
BRANCHES: CHICAGO: 320 Dearborn St. BOSTON: 134 Congress St. SAN FRANCISCO: 102 Sacramento St

# ELECTRICAL SUPPLIES.

## WESTERN ELECTRIC COMPANY,

CHICAGO. NEW YORK.

AGENCIES:
ELECTRIC APPLIANCE CO. CHICAGO, ILL.
PETTINGELL-ANDREWS CO., BOSTON, MASS.
ELECTRICAL ENGINEERING CO., MINNEAPOLIS, MINN.
ST. LOUIS ELECT'L SUPPLY CO., ST LOUIS, MO.
BRADFORD BELTING CO., CINCINNATI, OHIO.

# Phillips Insulated Wire Co.,

NEW YORK OFFICE: 39 and 41 Cortlandt St.
FACTORY: Pawtucket, R. I.

## WANTED.

A competent man to act as foreman of armature department. None but first-class men need apply. Give experience and class of work you have done. Apply

CANADIAN GENERAL ELECTRIC CO.,
Peterboro, Ont

## WANTED.

Competent wireman, dynamo tender and central station man. Steady work for right man. Address, stating experience and references,

TAGONA WATER & LIGHT CO.,
Sault Ste. Marie, Ontario.

## WANTED.

Position in an electrical repair shop or on a construction gang. Am a High School graduate and have had considerable experience in a repair shop. Address

"Repair Man,"
Care of WESTERN ELECTRICIAN.

## SITUATION WANTED.

Expert electrician, with good technical and all-round knowledge, is open to engagement as assistant engineer or electrician, or to superintend construction work; any branch. Address "Insulation,"
Care WESTERN ELECTRICIAN.
6 Lakeside Bldg., Chicago.

## POSITION WANTED.

Electrical and mechanical engineer of large and varied experience desires an opening as manager or engineer of some manufacturing or operating company; thorough practical mechanic and graduate; for past six years chief engineer of large manufacturing and operating works, designing, building, installing and operating all classes of electrical apparatus; familiar with estimate and contract work. "ENGINEER," care of WESTERN ELECTRICIAN, Chicago.

## WANTED.

Electrical engineer wants position with engineering company, manufacturing company, or central station. Position where business and technical work are combined will be preferred. Technical education, practical experience and good references.

Address "D. H. J.,"
Care of WESTERN ELECTRICIAN.

## INSOLVENT NOTICE.

In the matter of
LA CIE ELECTRIQUE ST. JEAN-BAPTISTE
Of the City of Montreal, Canada, P. Q.
In Liquidation.

The undersigned will sell by public auction, in three lots, at the office of Chas. Desmarteau, Liquidator, No. 1598 Notre-Dame St., Montreal, Canada, P. Q., on

*Thursday, the 19th of December 1895,*
*at eleven o'clock in the forenoon,*

All the immovable properties and movable assets of the said company, consisting of:

1. All those tracts and parcels of land situated in St. Jean Baptiste Ward, in the City of Montreal, Province of Quebec, Dominion of Canada, described as follows:

*A.* The northeasterly parts of lots numbers 32 (thirty-two), 33 (thirty-three) and 34 (thirty-four), according to the official subdivision of lot number 10 (ten), of the official cadastre, of the village of St. Jean Baptiste, comprising an area of 4,970 (four thousand nine hundred and seventy) feet, more or less; and bounded toward the northeast by Montana Street, toward the southeast by Rachel Street, toward the northwest by lot number thirty-five of said official subdivision of said lot number ten, and toward the southwest by the remaining parts of said lots numbers thirty-two, thirty-three and thirty-four of said official subdivision of said lot number ten, with buildings and dependencies thereon erected.

*B.* Lots numbers 35 (thirty-five), 36 (thirty-six), 37 (thirty-seven), 38 (thirty-eight), 39 (thirty-nine), 40 (forty), 41 (forty-one) and 42 (forty-two) of said official subdivision of said lot number 10 (ten), comprising an area of 17,296 (seventeen thousand two hundred and ninety-six) feet, more or less; bounded toward the northeast by Montana Street, toward the southwest by lot number sixty-one (*a*) of said subdivision of lot number ten, toward the northwest by lot number forty-three, and toward the southeast by lot number thirty-four of said subdivision of said lot number ten, together with the right of passage in common with adjoining proprietors in the lane at the rear of said lots.

*C.* All engines, boilers, dynamos, tank (45 000 gallons), machinery, belting, shafts and general plant used for manufacturing and generating electricity, as well as the wires and posts, transmitters, meters, lamps, etc., used for distributing and furnishing electric light to the citizens of Montreal and suburbs; the material and stock used for repairing the lines of the company, the whole amounting as per inventory to one hundred and forty four thousand three hundred and seventy-one dollars ($144,371.00).

*D.* The franchise rights and privileges acquired by said company to plant poles in the streets of the City of Montreal.

2. The office furniture and fixtures, etc., amounting to $196 00.

3. The book debts amounting, as per list, to $3,456.00.

The purchaser of the immovable and dependencies described in paragraph 1 shall have to make a cash deposit of five thousand dollars currency ($5,000) at the time of adjudication.

The purchasers of movable assets described in paragraphs 2 and 3 shall have to make a cash deposit of ten per cent. at the time of adjudication.

For further information apply to
CHAS. DESMARTEAU, Liquidator,
1598 Notre-Dame St.,
Montreal,
Canada, P. Q.

Marcotte Frère,
Auctioneers.

## WANTED.

By electrical engineer of 11 years' experience installing and operating lighting and power plants, position as superintendent of a lighting or power station. Can give best of references as to ability. A station which needs overhauling and systematizing preferred. Address "D. L. B.," care WESTERN ELECTRICIAN.

## FOR SALE CHEAP.

7½ H. P. 500 Volt C. & C. Motor, 3 H. P. 500 Volt Crocker-Wheeler Motor, and other second-hand machines.

E. R. HARDING,
1540 MARQUETTE BLDG., - CHICAGO.

## FOR SALE.

SMALL LOT OF

AMERICAN GAS ENGINE ELE. CO.'S STOCK

at 50 cents on the dollar

"C. E. R." care WESTERN ELECTRICIAN, Chicago.

*POSITIVELY*
The Best Made and Finest Finished Desk on the market for the money. Write for Catalog.
Ithaca Desk Co., Ithaca, N.Y.
$22

# FOR SALE.

The plant of the MATHER ELECTRIC CO., located at South Manchester, Conn. This plant has all the modern appliances for doing first-class work, is well equipped and will be sold at a bargain.

Apply to CHAS. M. JARVIS, Receiver, EAST BERLIN, CONN.

# FOR SALE, CHEAP!

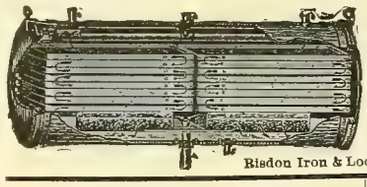
## NEW 50 LIGHT

# Arc Dynamo.

This machine has never been used. In fact, has not yet been taken out of shop. Is of leading manufacture and will be guaranteed direct to purchaser by makers. Will be sold for one hundred dollars under market for cash.

Address **DYNAMO,**
WESTERN ELECTRICIAN OFFICE.

# Stilwell's Patent Live Steam-Feed Water Purifier.



Risdon Iron & Loc'tive W'ks, S n Francisco, Cal., Pacific Coast Agt

**Removes all Impurities.**

Entirely prevents *scale* in Steam Boilers. Catalogue on application.

The Stilwell-Bierce & Smith-Vaile Co.,
DAYTON, OHIO.

## C. S. HART,

WHOLESALE

Telegraph, Telephone, Electric Light AND STREET RAILWAY POLES.

Manufactured from Live Cedar peeled. Quick shipments and best quality.
OCONTO, WIS.

## A. L. LEWIS,

Wholesale Producer of and Dealer in

CEDAR POLES AND TIES.

FROM THE STUMP TO THE CONSUMER.
Write for Prices.
Menominee, - - Michigan.

## FOR SALE.

CHEAP FOR CASH.

Good electrical supply and construction business in live southern city. Good reasons for selling.

Address "Southern,"
Care WESTERN ELECTRICIAN, Chicago.

# Scrap Copper Wire

## WANTED.

It will pay the Electrical Plants to save their Scrap Copper Wire and ship to us in any quantity, at the following prices, f. o. b. Chicago, cash on receipt of same:

| | | |
|---|---|---|
| Bare Copper Trolley Wire | 9 | cts. per lb. |
| Ordinary Bare Copper Wire Scrap, | 8½ | " " |
| Insulated Copper Wire | 5 to 8 | " " |
| Heavy Red Scrap Brass | 7½ | " " |
| Heavy Yellow Scrap Brass | 6¼ | " " |
| Light Sheet Brass | 3¾ | " " |

We receive metals in any quantity and send prompt returns. We also supply the Electrical trade with Cotton Waste, in bales of 100 and 500 lbs., also Babbitt, in lots of 100 lbs. and over, at the very lowest prices. It will pay you to correspond with us. Address

## Swarts Metal Refining Co.,

CHICAGO'S LEADING METAL HOUSE,

Established 1885. Incorporated 1895.
120-122 W. Lake St., CHICAGO, ILL.

Write for Illustrated Catalogue.

# INDIA AND AMBER MICA.

Can furnish any size, shape or pattern. Write for samples and quotations.

A. O. SCHOONMAKER, Importer,
158 William St., New York.

# WE REWIND

## *Dynamos and Motors*

To any Voltage.

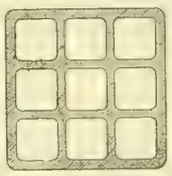
Send your Machines to us for Repairs.

PROMPT AND EFFICIENT WORK GUARANTEED.

## Hartley Electrical Works,

REPAIRERS OF
Electrical Apparatus
AND DEALERS IN
*Second Hand Dynamos, Motors and Transformers,*
373 Dearborn St., Chicago.

# CONDUITS.



In lengths of 4 ft. 6 in., any number of ducts.

Are you interested in Conduits? If you are it will pay you to look into the merits of the latest — undoubtedly the best.

JOHN T. McROY,
36 S. Clark Street, Chicago.

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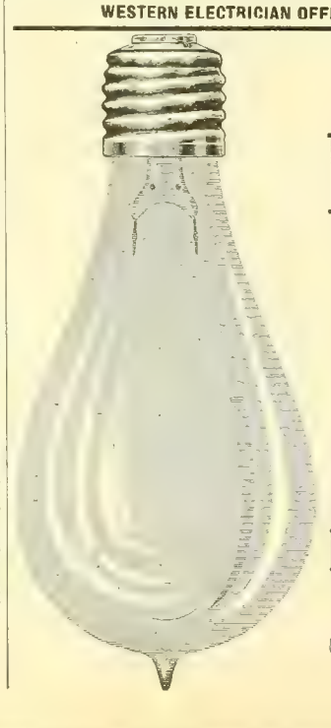
*Mechanical and Architectural Drawing, Steam Engineering (Stationary, Marine, Locomotive), Plumbing, Heating, Civil Engineering, Coal and Metal Mining, English Branches,*

TAUGHT BY MAIL.

Twenty-seven Courses of Study. Send for *free* circular. State subject you wish to study,

The International Correspondence Schools,
SCRANTON, PA.



# BEACON Incandescent Lamp.

From ½ to 300 Candle Power. Unrivalled for long life, economy in current consumption and freedom from blackening.

Special attention to the export trade.

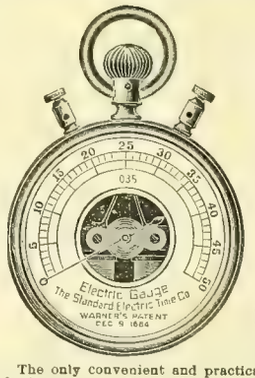
Send for new catalogue of Multiple, Series, Miniature and Decorative Lamps. Orders filled promptly. Lowest prices.

## BEACON LAMP CO.,

Irvington & Harcourt Sts., Boston, Mass.

☞ The Royal Electric Co., of Montreal Quebec, Sole Agents for Canada.

# THE ELECTRIC GAUGE.

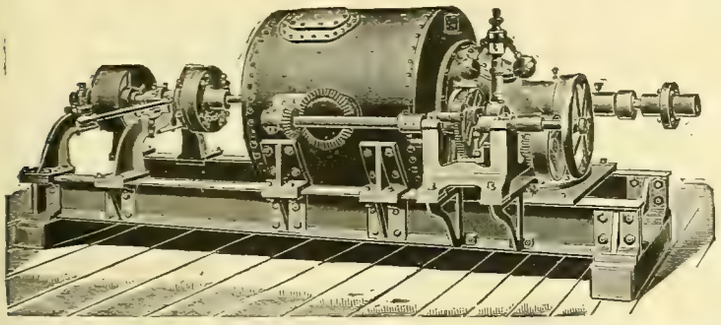



For Testing Batteries and the Strength of Battery Currents.

The only convenient and practical instrument for the purpose. It is indispensable to those using batteries and having the care of them. The Pocket Gauge is the size of an ordinary watch, and is very convenient for the use of linemen, inspectors, etc. Price, $8.00. Call for WARNER'S PATENT ELECTRIC GAUGE. Manufactured only by

The Standard Electric Time Co., Waterbury, Conn.

# VICTOR TURBINE WATER WHEEL.



Cylinder or Register Gate—Close Regulation and High Efficiency at Full and Partial Gate.

The attention of ELECTRIC COMPANIES is called to this **CELEBRATED WATER WHEEL** as particularly adapted to their use, on account of its **remarkably steady motion, high speed and great efficiency and large capacity** for its **diameter**, being **double** the **power** of most wheels of the same diameter. It is used by a number of the leading electric companies with great satisfaction. In the economical use of water it is without an equal, producing the highest per cent of useful effect **guaranteed.**

***SEND FOR CATALOGUE AND PARTICULARS.***

The accompanying engraving represents a single 10-inch Victor Turbine on horizontal shaft to develop 36 H. P. under 38 feet head. Arranged with 12-inch Worrell Friction Coupling at one end to disconnect pulley.

We are now prepared to furnish Victor Turbines, either single or in pairs, on horizontal shafts, and where the situation admits of their use we recommend them.

**The Stilwell-Bierce & Smith-Vaile Co., Dayton, Ohio.**

Risdon Iron & Locomotive Works, San Francisco, Cal., Pacific Coast Agents.

*The Standard Open Circuit Batteries of the World.*

SEND FOR CIRCULAR AND PRICES.

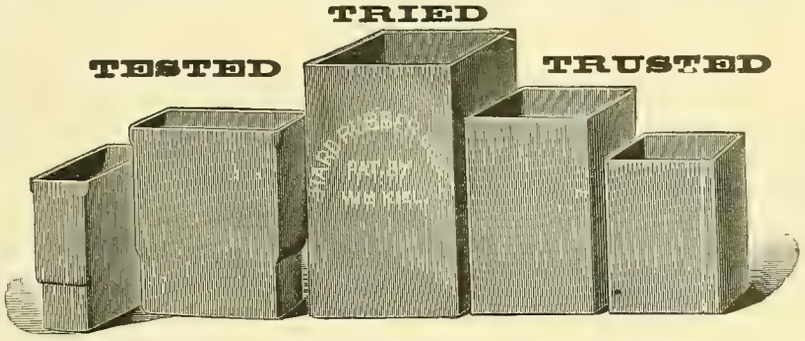
**THE LECLANCHE BATTERY CO.,**

111 to 117 East 131st St., N. Y.

## Most Durable Battery Cells Produced.

TRIED

TESTED TRUSTED




ROD SHEET, TUBING.

Flexible Hard Rubber Tubing.

INSULATOR HOOKS.

Telephone Receivers, Battery Syringes, Bushings, Etc.

**Manufactured by The Butler Hard Rubber Co., 33 Mercer St., N. Y.**

## WIRT BRUSHES

Are made only by

Charles Wirt, 1026 Filbert, Philadelphia.

For Sale by the Trade.

**H. T. Paiste Co.**

Trade Agents: 369 Wabash Ave., Chicago.

Wm. J. Alexander, Pres. Telephone, Main
Geo. T. Schuster, Vice-Pres. 1096.
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196 and 198 Clark Street, Chicago.

Fine Book and Catalogue Work a Specialty.

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has induced the Nickel Plate Road to sell excursion tickets at very low rates to all points on its line between Chicago and Buffalo during the Holidays. Tickets at one and one-third fare for the round trip. Special excursion dates December 24th, 25th, 31st and January 1st, good returning until January 2d. For further information address J. Y. Calahan, Gen'l Agent, 111 Adams St., Chicago, Ill. Memo No. 113.

PRIMARY BATTERIES.

## OVER 5 VOLTS-5 AMPERES FROM 1 CELL

BOYNTON MULTIVOLT BATTERY CO., 10, 12 and 14 Whipple Street, BROOKLYN, N. Y.

ONE SOLUTION.

Size, 6x8 in.

**Price, $6.50.**

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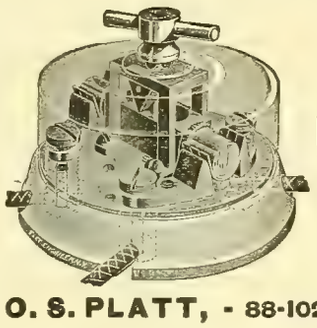

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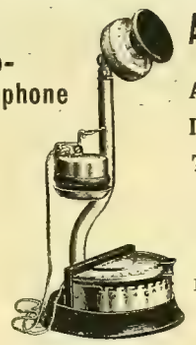

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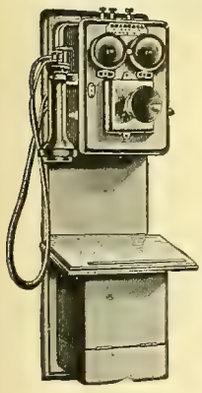

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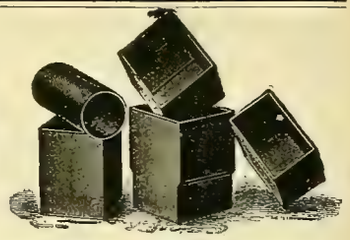

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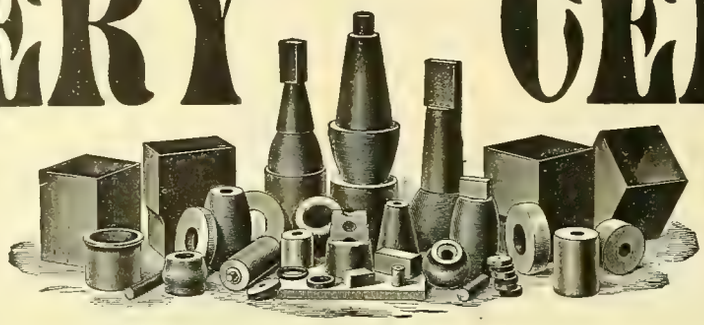

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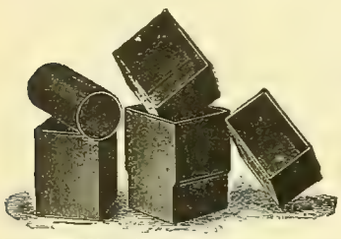

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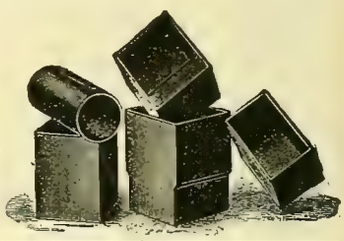

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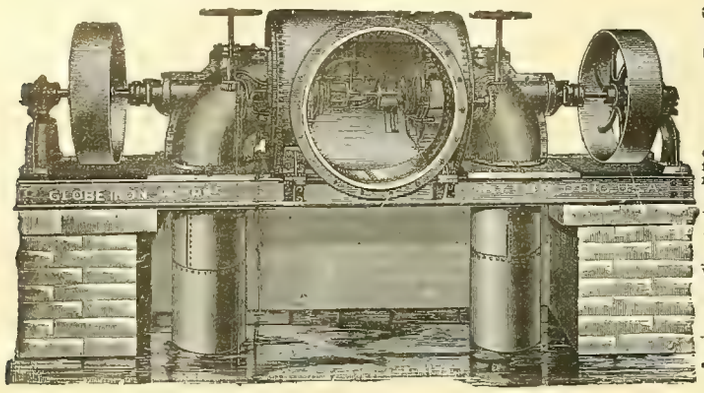

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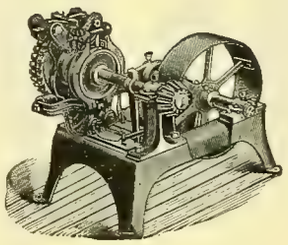

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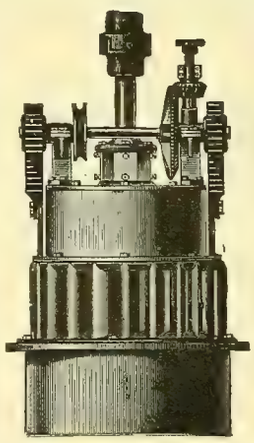

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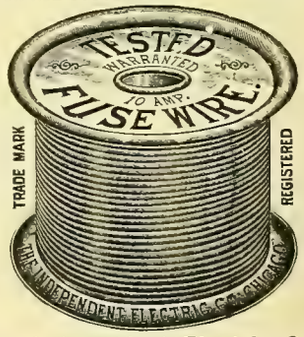


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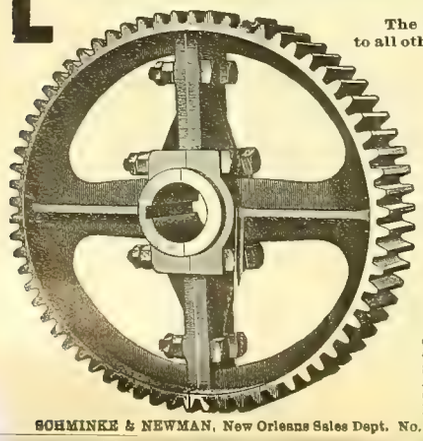

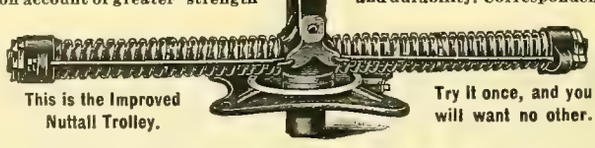

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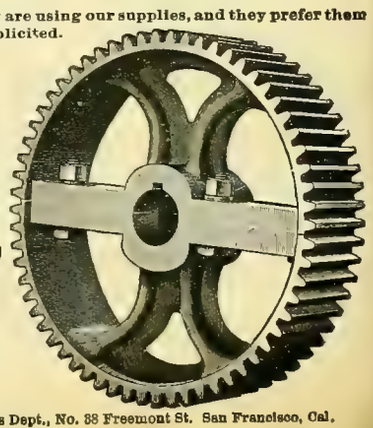

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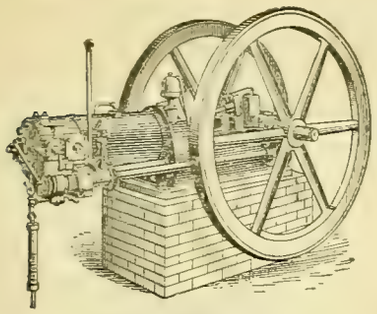

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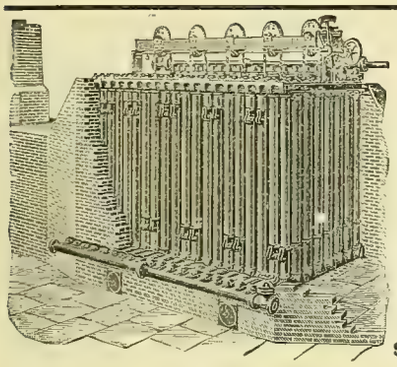

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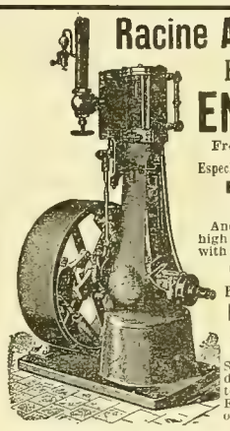

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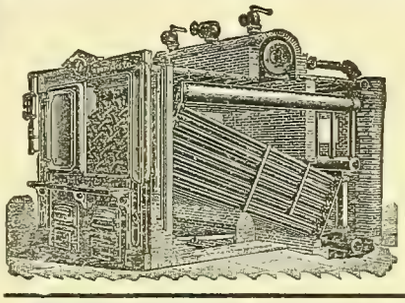

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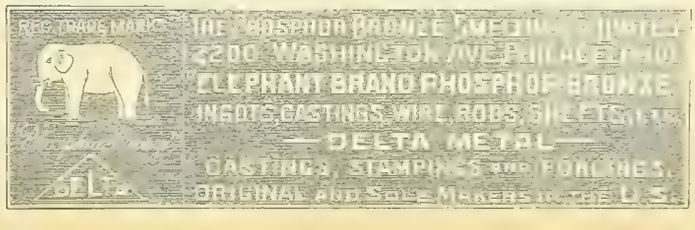

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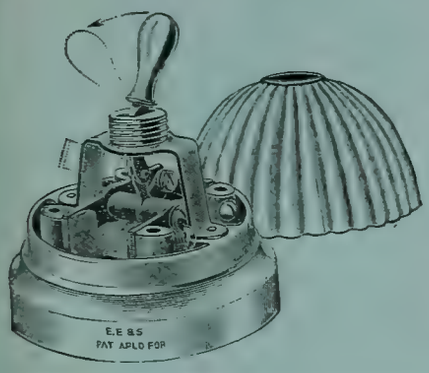


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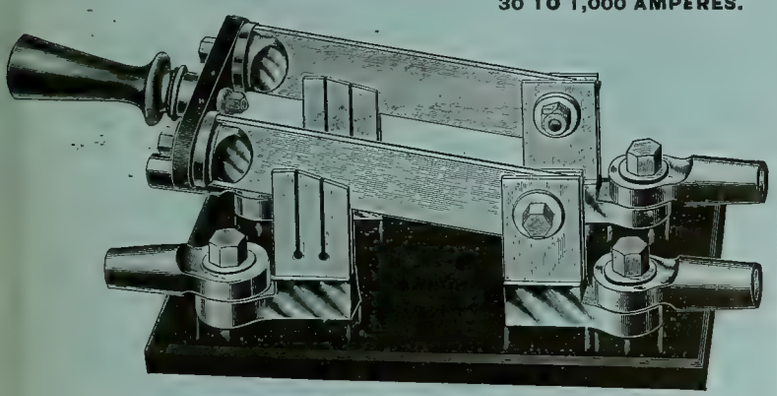

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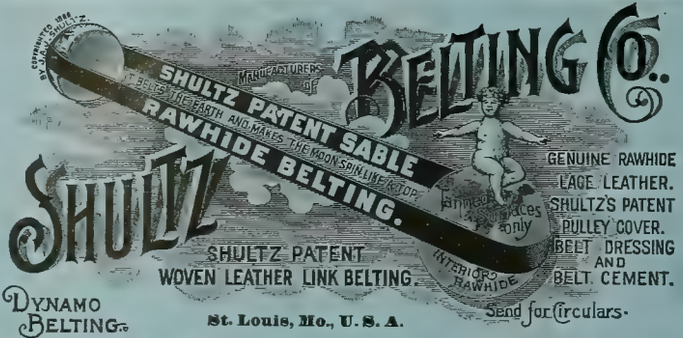


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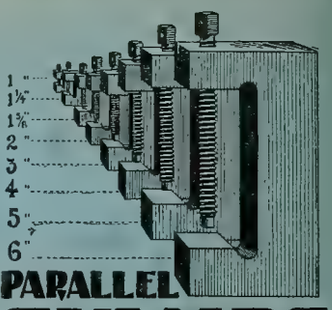


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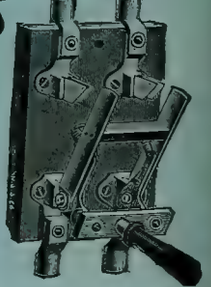

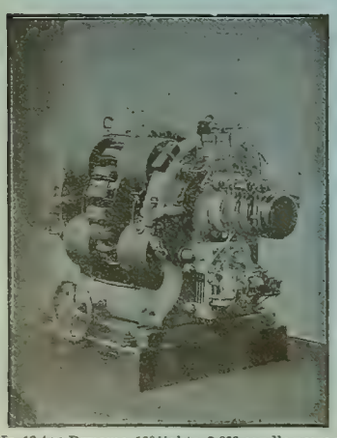

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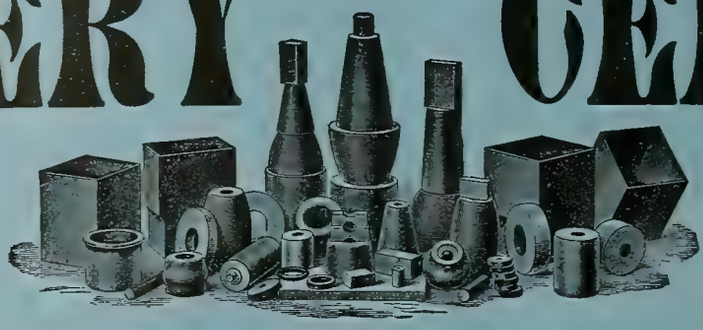

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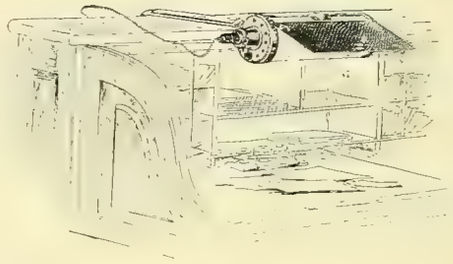

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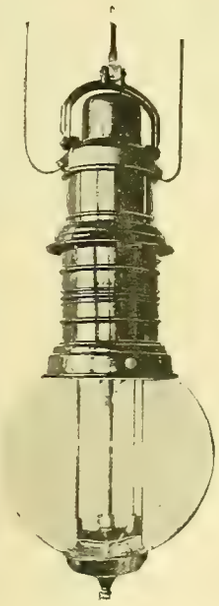

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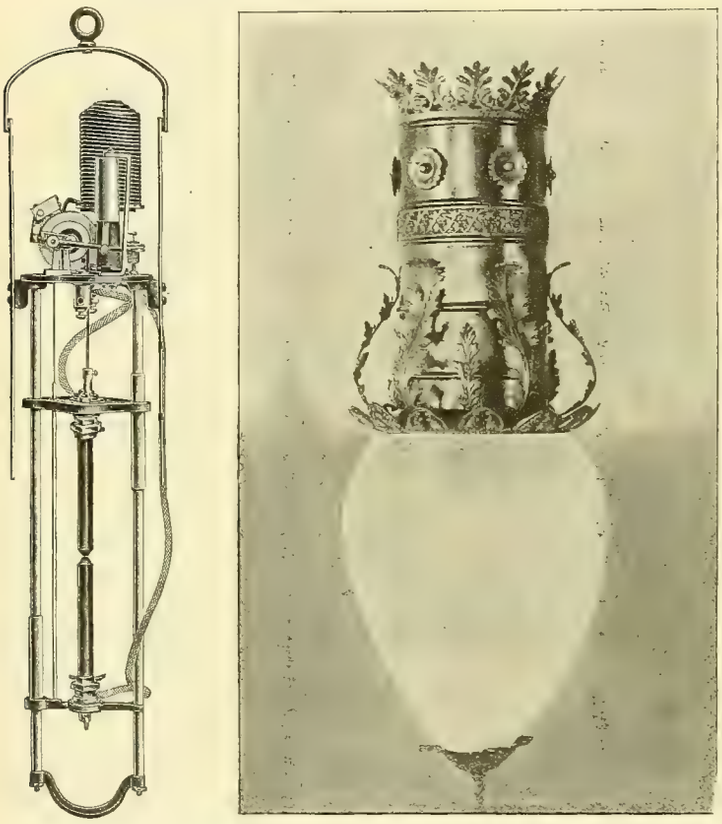

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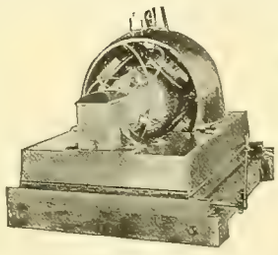

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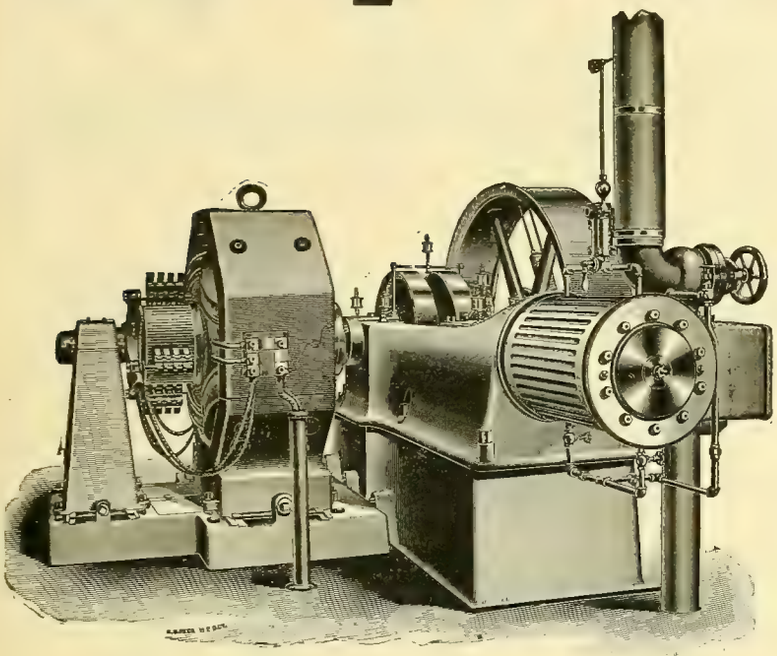

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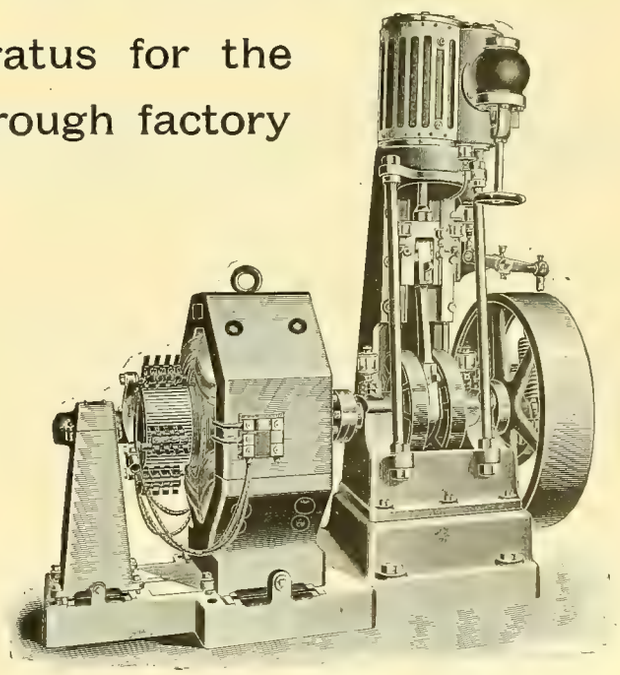

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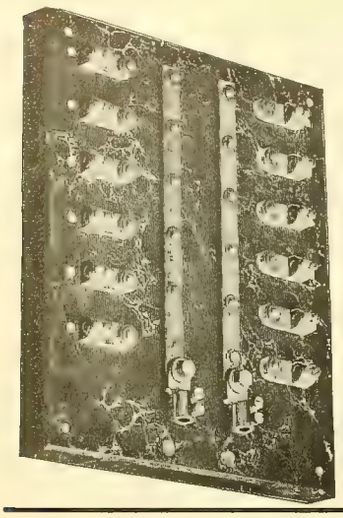

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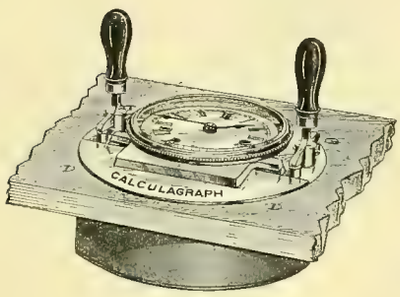


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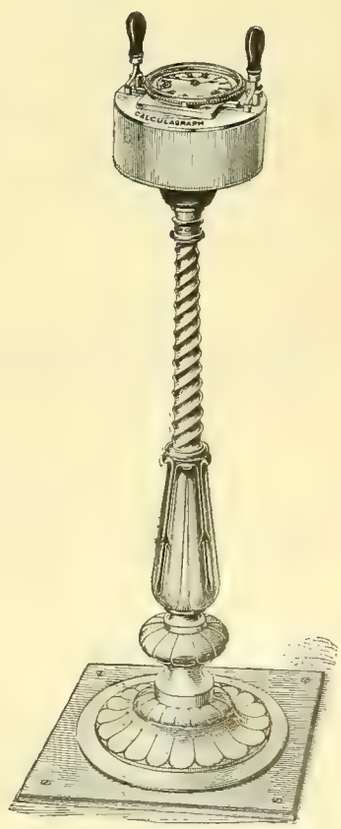


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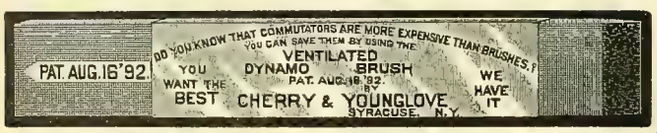


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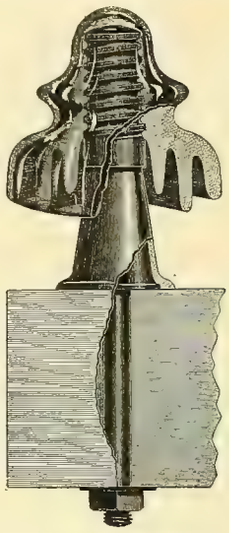

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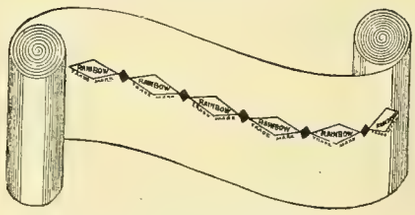

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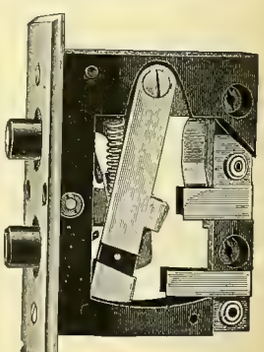

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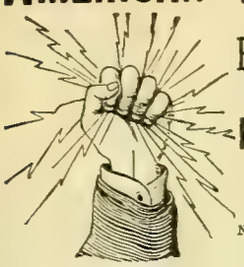

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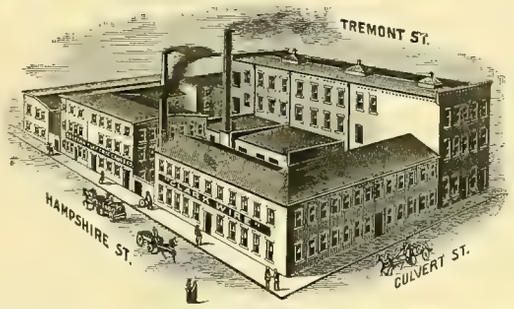


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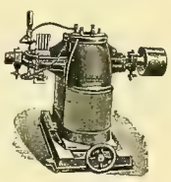

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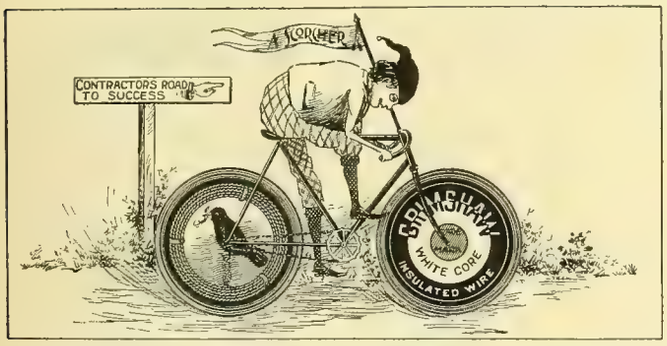


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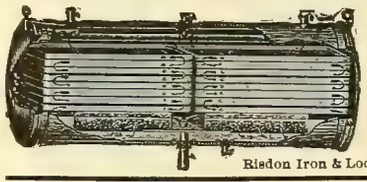

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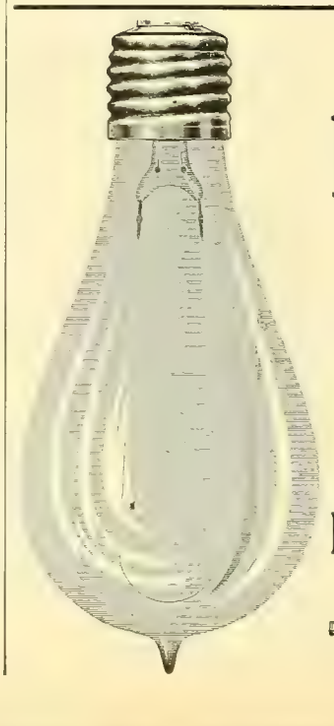

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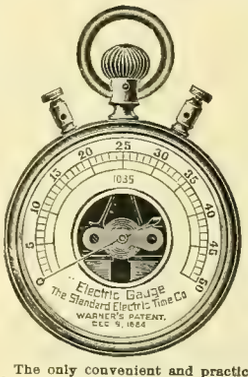


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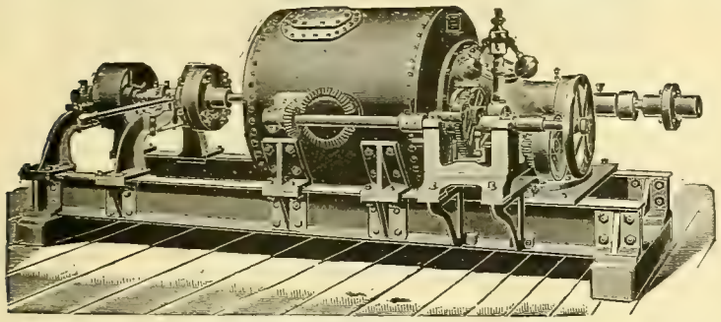

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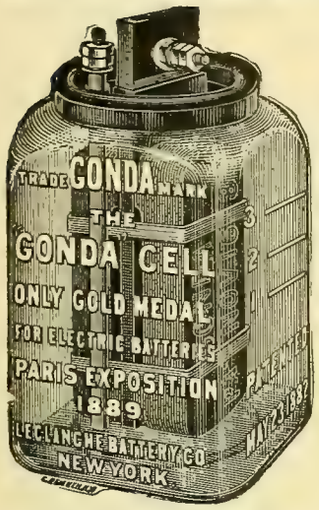


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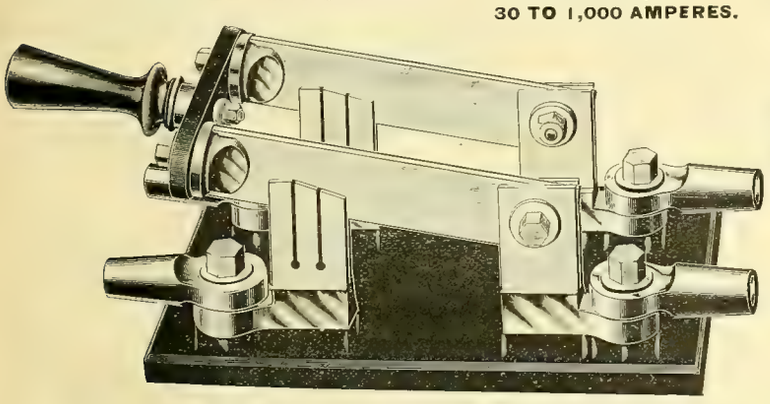

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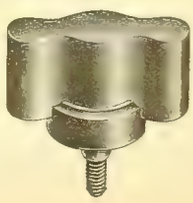

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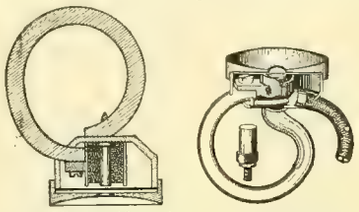
ductor. In the D'Arsonval receiver a curved permanent magnet is used, one pole of which terminates



FIGS. 27 AND 28. D'ARSONVAL RECEIVER.

in a soft iron polepiece that serves as the core of the coil, and the other in an iron box, or cylinder, that

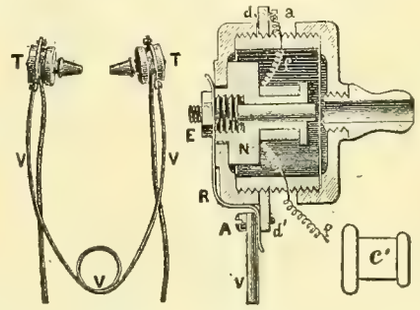



FIG. 29. MERCADIER'S BI-TELEPHONE. *T T* RECEIVERS, *V* SPRING, *N* MAGNET, *E* NUT, *R* STEEL STRIP, *A* SCREW CLAMPING *R* TO *V*, *d d'* METAL COLLAR CLAMPING *V* TO RECEIVER CASE, *f f* TERMINALS OF COIL *a* CONNECTING SCREW, *c'* SOFT RUBBER NIPPLE FOR EARPIECE.

completely encloses the coil. The two poles are magnetically insulated from each other by the wooden case, to the upper part of which the diaphragm is

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appeared on the scene with an application for a patent on a microphonic transmitter, and according to the rules of the Patent Office no patent could be issued to any of the three until it was determined whether the Drawbaugh claim was valid or not. This was finally decided against Drawbaugh, as it was proved that the Edison carbon transmitter had been in public use for more than two years before Drawbaugh made his application for a patent, and his application was thrown out. A patent was then issued to Berliner on the broad

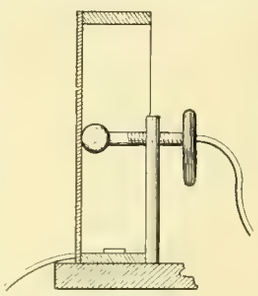

FIG. 44. BERLINER'S FIRST TRANSMITTER.

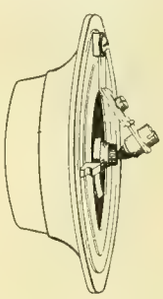

FIG. 45. BERLINER CARBON TRANSMITTER.

principle of the microphone transmitter in November, 1891. In May of the following year a patent was issued to Edison, so that both sides of the interference eventually got their patents—more than fourteen years after the filing of the original applications.

78. Both Berliner and Edison obtained in 1878 patents on special forms of transmitters designed in accordance with the principles laid down in their applications for the broad principle of battery telephones, and the Berliner transmitter especially has been modified out of all semblance to its original form. The broad claim in the Berliner patent is as follows: "The method of producing in a circuit electrical undulations similar in form to sound waves by caus-

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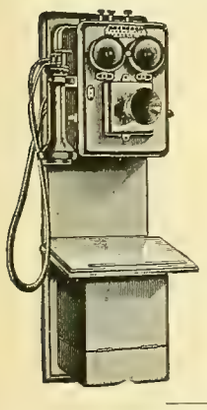

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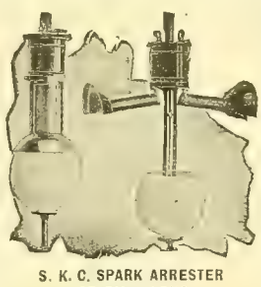

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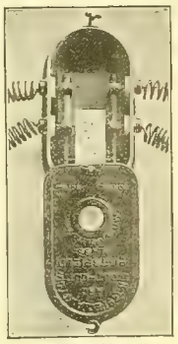

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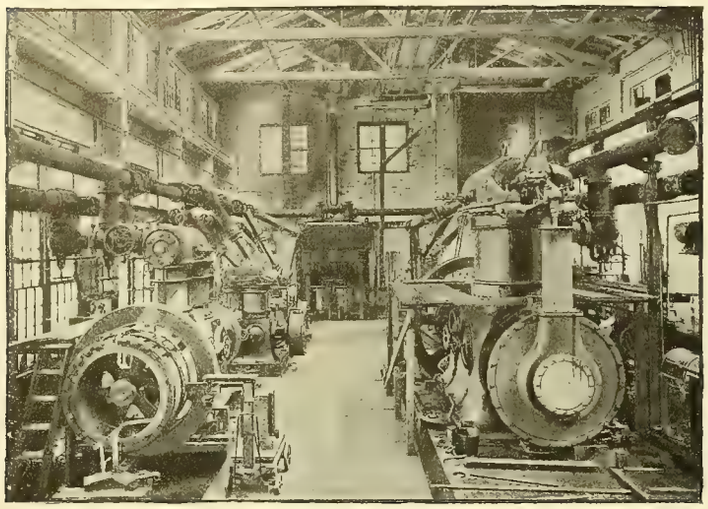

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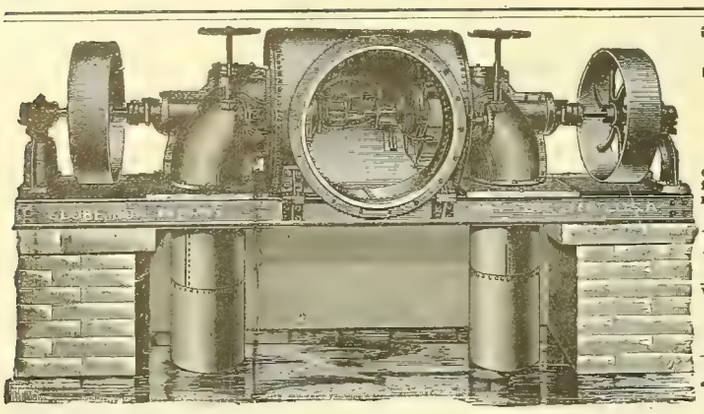

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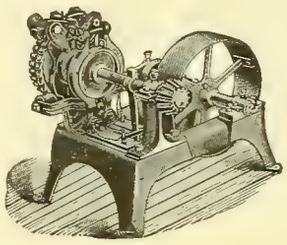

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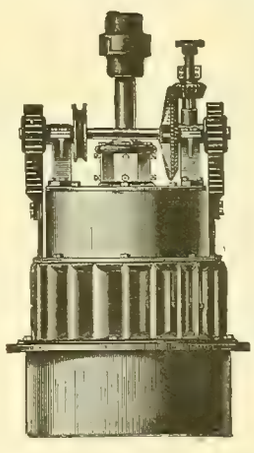

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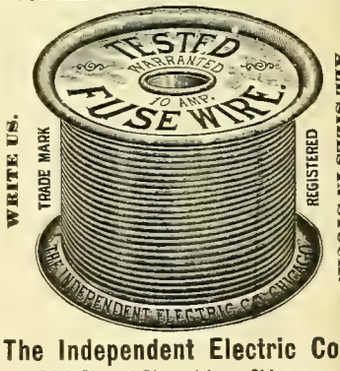


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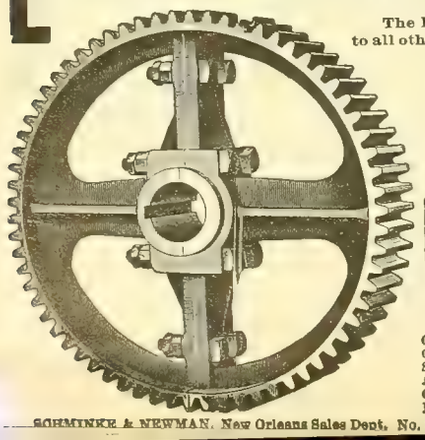

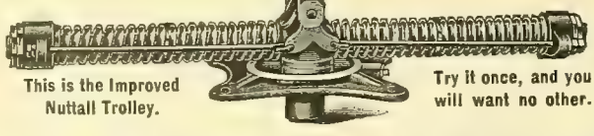

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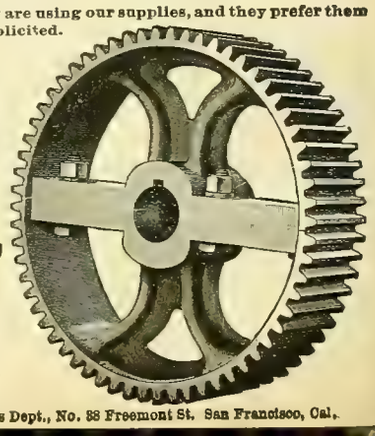

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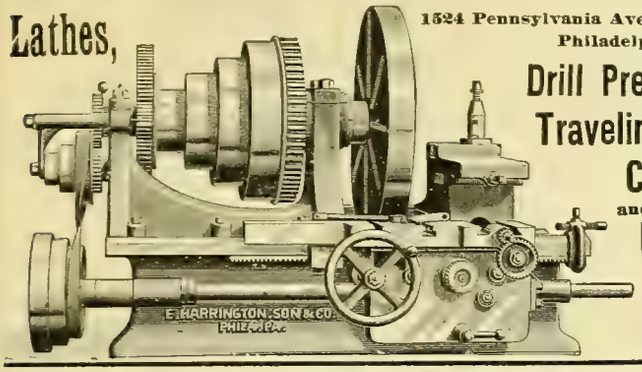


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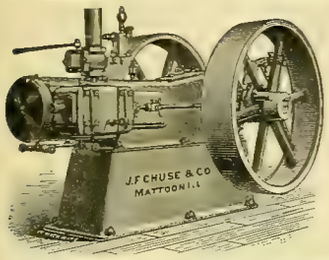


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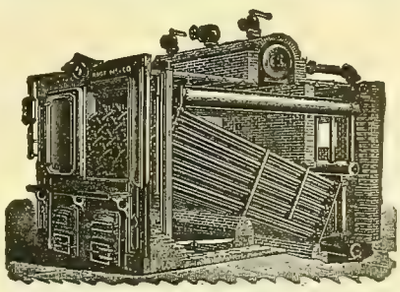

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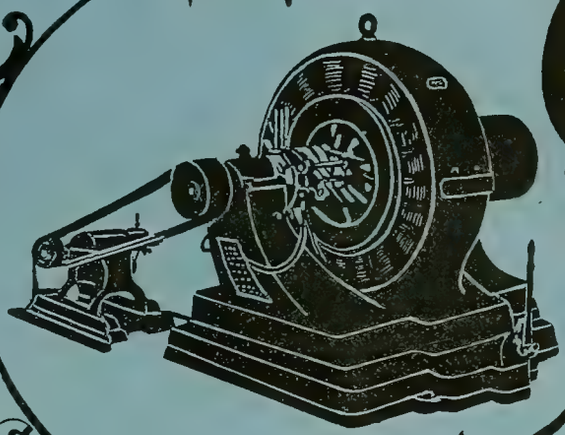

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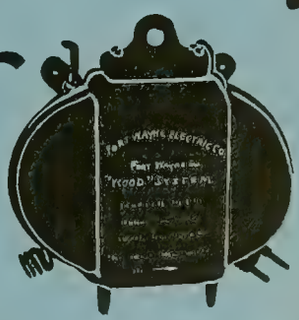

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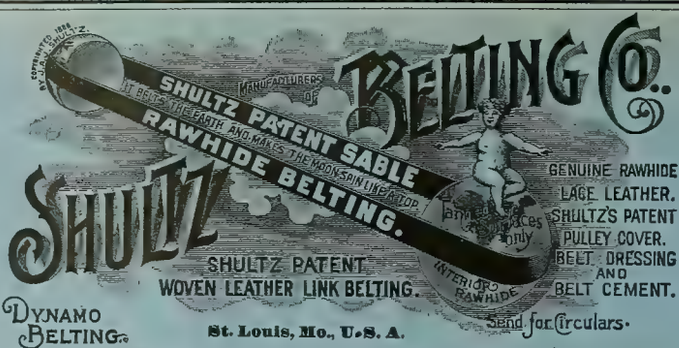


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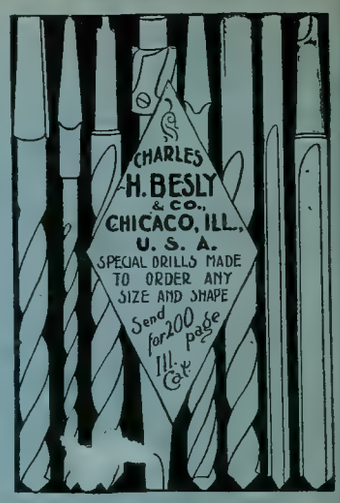


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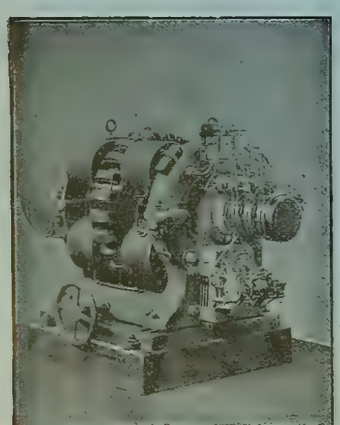

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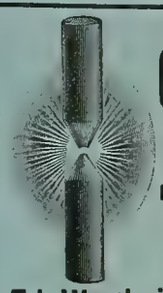

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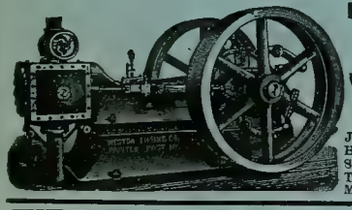

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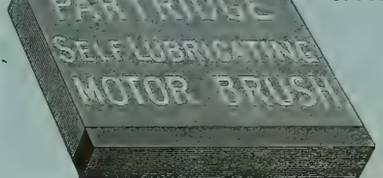


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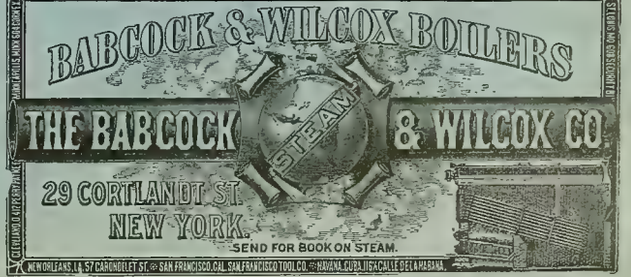


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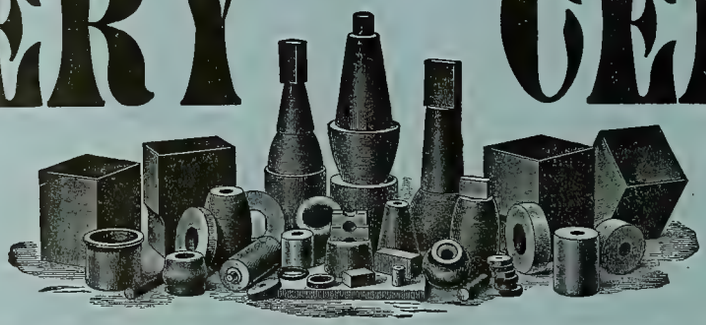

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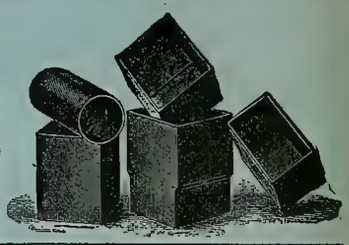

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## CLASSIFIED LIST.


**Accumulators.**
American Battery Co.
Electric Storage Battery Co.
Ohio Storage Battery Co.

**Annunciators.**
Central Electric Co.
Chicago Gen'l Fixture Co.
Electric Appliance Co.
Mason, J. W.
Menominee El. & Mech. Co.
Ostrander & Co., W. R.
Partrick & Carter Co.

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Adams-Bagnall Elec. Co.
Central Electric Co.
Chicago Gen'l Fixture Co.
Fleming-Spence Elec. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Helios Electric Co.
Standard Electric Co.
Waterman C. H.
Westinghouse El. & Mfg. Co.

**Arc Light Cord.**
Samson Cordage Wks.

**Batteries and Jars.**
Boynton Multivolt Batt'y Co.
Butler Hard Rubber Co.
Central Electric Co.
Chicago Gen'l Fixture Co.
Commercial Elec. Sup. Co.
Edgerton Pottery Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric Storage Battery Co.
Gordon-Burnham Bat. Co.
Kester Elec. Mfg. Co.
Leclanche Battery Co., The.
Mason, J. W.
Menominee El. & Mech. Co.
Newton Rubber Wks.
Ohio Storage Battery Co.
Partrick & Carter Co.
Western Electric Co.

**Bells.**
Central Electric Co.
Electric Appliance Co.
Menominee El. & Mech. Co.
National Electric Co.
Ostrander & Co., W. R.
Partrick & Carter Co
Western Electric Co.

**Belting.**
Chicago Belting Co.
Shultz Belting Co.

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Abendroth & Root Mfg. Co.
Babcock & Wilcox Co., The.
Clonbrock Steam Boiler Co.
Moyes, L. M.
Murray Iron Works Co.
Racine Hardware Co.
Weston Engine Co.

**Books, Electrical.**
Electrician Publishing Co.

**Bronze.**
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co., Ltd.

**Brushes.**
Bernardin, F. M.
Boudreaux Dyn. Brush Co.
Central Electric Co.
Holmes Fibre-Graphite Co.
Kester Elec. Mfg. Co.
Mason, J. W.
Partridge Carbon Co.
Solar Carbon & Mfg. Co.
Wirt, Chas.
Youngiove & Gere.

**Burglar Alarms.**
Central Electric Co.
Electric Appliance Co.
Menominee El. & Mech. Co.
Partrick & Carter Co.
Western Electric Co.

**Cables** (See Insulated Wires.)

**Cables, Electric** (See Insulated Wires), **Copper, Sheet and Bar.**
American Elec. Works.
Brixey, W. R.
Central Electric Co.
Eastern Electric Cable Co.
Elec. Engr. & Supply Co.
Moore, Alfred F.
New York Ins. Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Western Electric Co.

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Bernardin, F. M.
Central Electric Co.
Chicago Gen'l Fixture Co.
General Electric Co.
Hardtmuth & Co., F.
Mason, J. W.
Partridge Carbon Co.
Reisinger, Hugo.
Solar Carbon & Mfg. Co.
Wertheim, Ed.
Western Electric Co.

**Cigar Lighters.**
National Electric Co.

**Compound.**
Kester Elec. Mfg. Co.

**Conduits.**
Central Electric Co.
Interior Conduit & Ins. Co.
McRoy, Jno. T.

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Bernardin, F. M.
Ft. Wayne Elec. Corporation.
Homer & Co., F. E.
Richards & Meacham.

**Contractors and Electric Light Plants.**
Arnold, B. J.
Bain, Foree.
Brush Electric Co.
Bryan, Wm. H.
Card Electric Co.
Eddy Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
Gates Elec. Mfg. Co.
General Electric Co.
Kester Electric Co.
Interior Conduit & Ins. Co.
Perkins, Frank C.
Schott, W. H.
Siemens & Halske Elec. Co.
Standard Electric Co.
United Elec Improvement Co
Westinghouse Elec & Mfg. Co.
Western Electric Co.

**Copper.**
Besly & Co., Chas. H.

**Copper Wires.**
American Electrical Works.
Bernardin, F. M.
Besly & Co., Chas. H.
Brixey, W. R.
Central Electric Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.
Mason, J. W.
Menominee El. & Mech. Co.
National India Rubber Co.
Okonite Co. The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Western Electric Co.

**Cordage.**
McEvoy, C. H.
Samson Cordage Wks.

**Cranes.**
Harrington, Son & Co., E.

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Anderson, Albert & J. M.
Bernardin, F. M.
Brady, T. H.
Central Electric Co.
Central Mfg. Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Locke, F. M.
Mason, J. W.
Nuttall Co., R. D.
Partrick & Carter Co.

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Anderson, Albert & J. M.
Bernardin, F. M.
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Central Electric Co.
Chicago Edison Co.
Chicago Gen'l Fixture Co.
Commercial Elec. Sup. Co.
Eddy Elec. Mfg. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric Protection Co.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Forest City Elec. Wks.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hart & Hegeman Mfg. Co.
Interior Conduit & Ins. Co.
Kester Electric Co.
Louisville Elec. Wks.
MacCurdy & Smith.
Mason, J. W.
Menominee El. & Mech. Co.
Nuttall Co., R. D.
Partrick & Carter Co.

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McLeod, Ward & Co.

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Ithaca Desk Co.

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Card Electric Co.
Central Electric Co.
Colburn El. Mfg. Co.
Eddy Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
Gates Elec. Mfg. Co.
General Electric Co.
Interior Conduit & Ins. Co.
Kester Electric Co.
Michigan Electric Co.
Roth Bros. & Co.
Siemens & Halske Elec. Co.
Standard Electric Co.
Walker Mfg. Co.
Westinghouse Elec. & Mfg. Co.

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Card Electric Co.
General Electric Co.
Siemens & Halske Elec. Co.
Westinghouse El. & Mfg. Co.

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Bain, Foree.
Bryan, Wm. H
Eddy Elec. Mfg. Co.
Perkins, Frank C.
Schott, W. H.

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Commercial Elec. Sup. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Interior Conduit & Ins. Co.
Nuttall Co., R. D.
Partrick & Carter Co.
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Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.

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Nuttall Co., R. D.

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Bernardin, F. M.
Besly & Co., Chas. H.
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Central Electric Co.
Chicago Edison Co.
Chicago Gen'l Fixture Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric Protection Co.
Farr Tel. & Const. Supply Co.
Forest City Elec. Wks.
General Electric Co.
Interior Conduit & Ins. Co.
Louisville Elec. Wks.
MacCurdy & Smith.
Mason, J. W.
McLeod, Ward & Co.
Menominee El. & Mech. Co.
Metropolitan Electric Co.
National Electric Co.
Partrick & Carter Co.
Queen & Co. Inc.
Sioux City Brass Works.
S. K. C. Specialty Co.
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Lombard Water Wheel Gv. Co.

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Newton Rubber Wks.

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Bernardin, F. M.
Brixey, W. R.
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Central Electric Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Empire China Works.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Hart & Hegeman Mfg. Co.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Locke, Fred M.
Louisville Elec. Wks.
MacCurdy & Smith.
Mason, J. W.
Menominee El. & Mech. Co.
Munsell & Co., Eugene.
National India Rubber Co.
Newton Rubber Wks.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.

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American Electrical Works.
Brixey, W. R.
Central Electric Co.
Commercial Elec. Sup. Co.
Eastern Electric Cable Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
General Electric Co.
Independent Electric Co.
Mason, J. W.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.

**Lamp Guards.**
Inglis, Wm.

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Adams-Bagnall Elec. Co.
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Buckeye Electric Co.
Central Electric Co.
Columbia Inc. Lamp Co.
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New York & Ohio Co.
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General Electric Co.

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Munsell & Co. Eugene.
Schoonmaker, A. O.

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Independent Electric Co.
Westinghouse El. & Mfg. Co.

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Brush Electric Co.
Card Electric Co.
Central Electric Co.
Colburn El. Mfg. Co.
Eddy Elec. Mfg. Co.
Elec. Engr. & Supply Co.
Ft. Wayne Elec. Corporation.
Gates Elec. Mfg. Co.
General Electric Co.
Interior Conduit & Ins. Co.
Kester Electric Co.
Menominee El. & Mech. Co.
Michigan Elec. Co.
Roth Bros. & Co.
Sioux City Brass Works.
Standard Electric Co.
Stanley Elec. Mfg. Co.
Storey Motor & Tool Co.
Walker Mfg. Co.
Westinghouse El. & Mfg Co.

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Garlock Packing Co.
Peerless Rubber Mfg. Co.

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Baker & Co.

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Hart, C. S.
Lewis, A. L. & Co.
Lindsley Bros.
Morris, Tasker & Co.
Nuttall Co., R. D.

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Commercial Elec. Sup. Co
Empire China Works.
General Electric Co.
Locke, F. M.

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**Push Buttons.**
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Electric Appliance Co.
National Electric Co.
Partrick & Carter Co.

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General Electric Co.
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Klipstein & Co., A.

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Electric Appliance Co.
Ostrander & Co., W. R.
Partrick & Carter Co.

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Queen & Co. Inc.
Weston Electrical Inst. Co.
Whitney Elec. Inst. Co.

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Central Electric Co.
Electric Appliance Co.
Moore, Alfred F.
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Okonite Co., The.
Simplex Electrical Co.

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Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

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Berliner Telephone Co.
Central Electric Co.
Commercial Elec. Sup. Co.
Farr Tel. & Const. Supply Co
Gustafson, W. A.
Keystone Telephone Co.
Mason, J. W.
McEvoy, C. H.
Richards & Meacham.
Sill, A. D.
Standard Tel. & Elec. Co.
U. S. Tel. Const. Co.
Western Electric Co.
Western Tel. Const. Co.
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Stanley Electric Mfg. Co.

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Samson Cordage Wks.

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Westinghouse El. & Mfg. Co.

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Leffel & Co., Jas.
Replogle Governor Wks.
Smith, S. Morgan.
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Int. Corr. Schools.

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Leffel & Co., Jas.
Replogle Governor Wks.
Smith, S. Morgan.

**Wire, Bare.**
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Besly & Co., Chas. H.
Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
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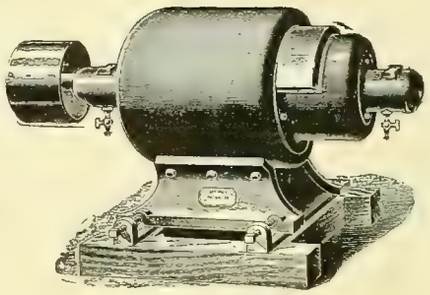

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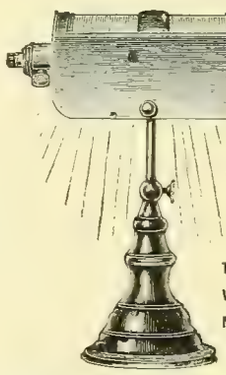

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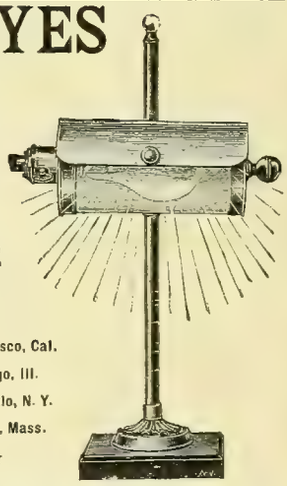

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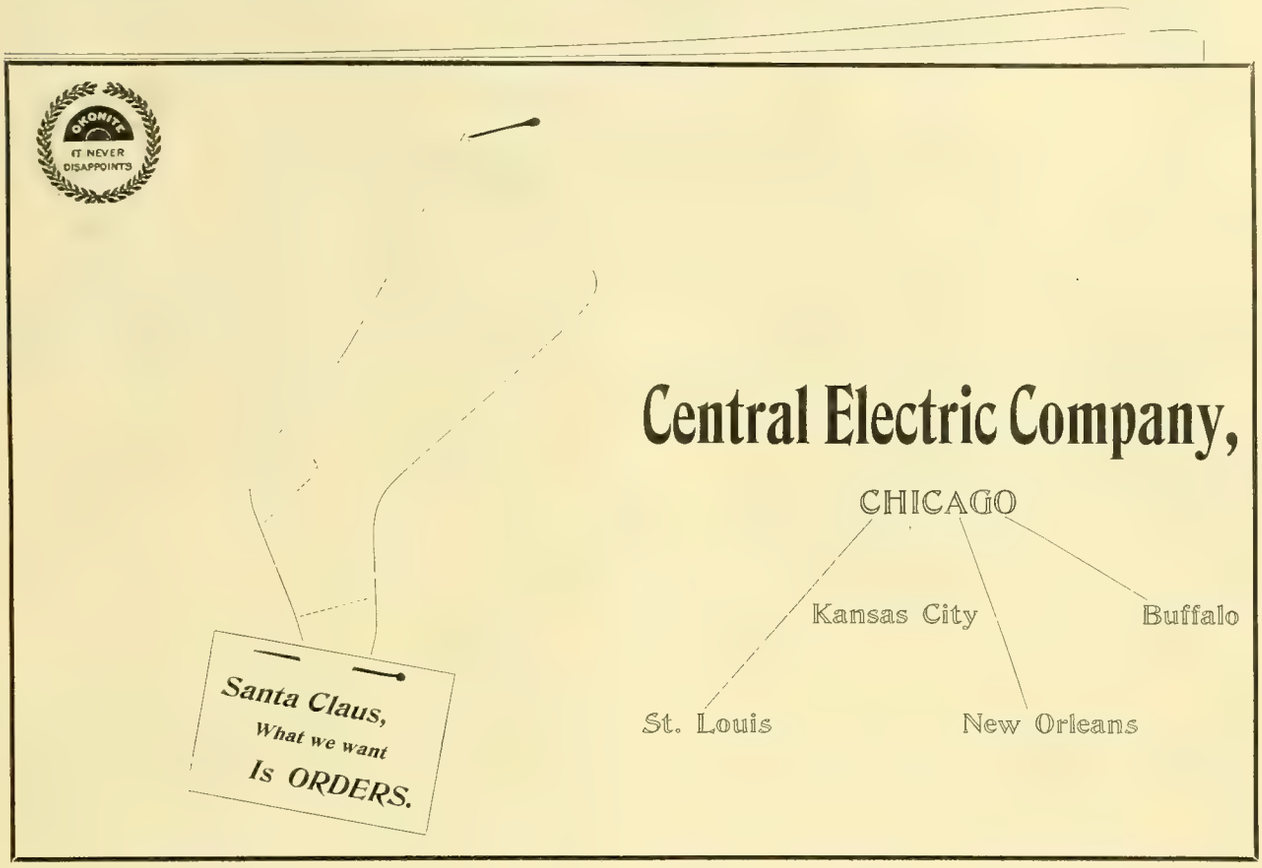


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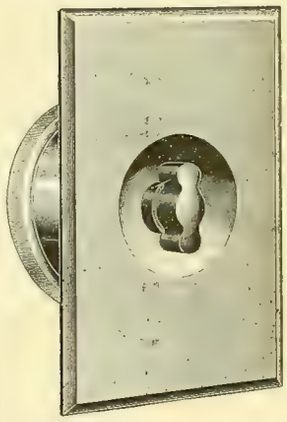

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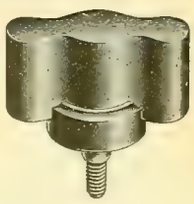

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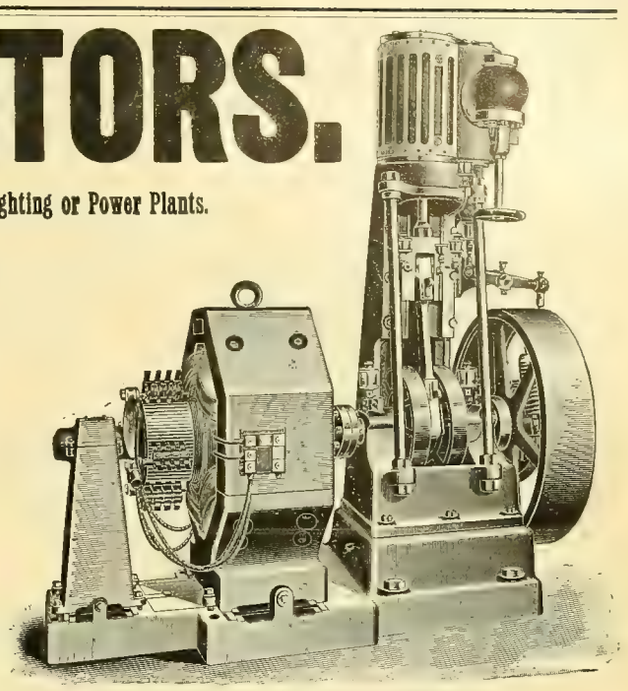

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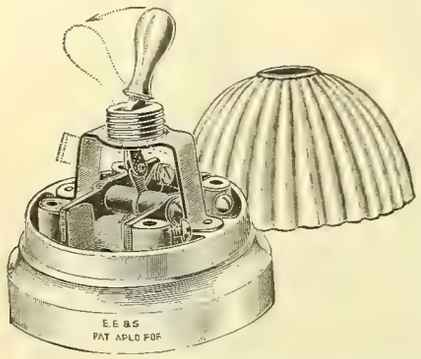


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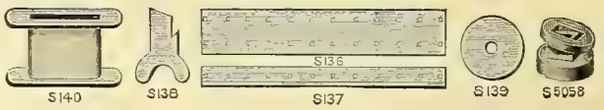


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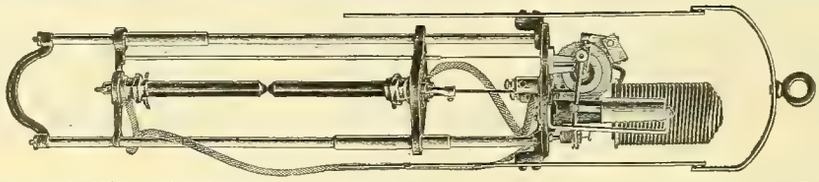

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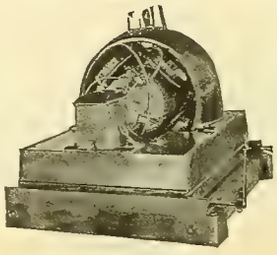

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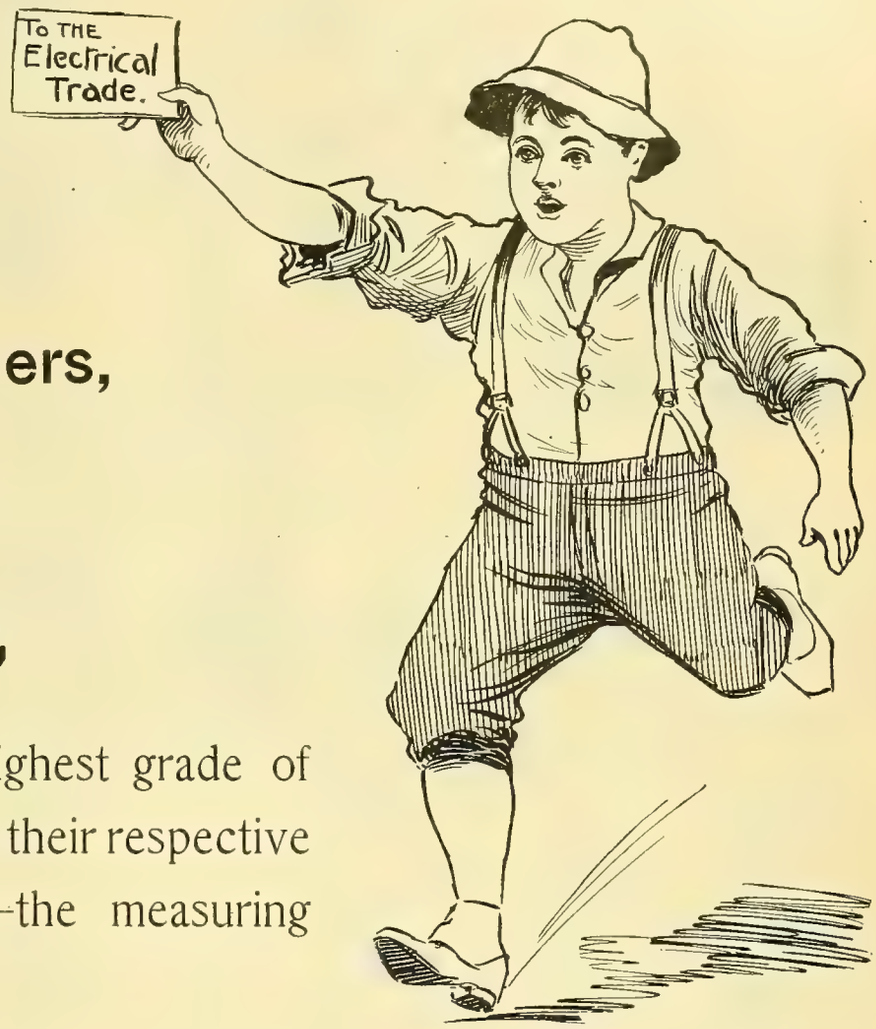


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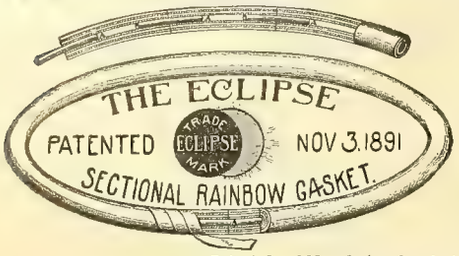


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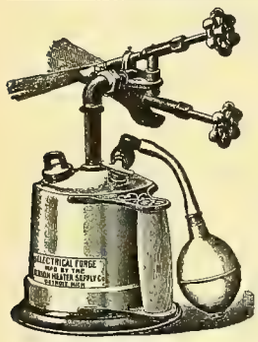

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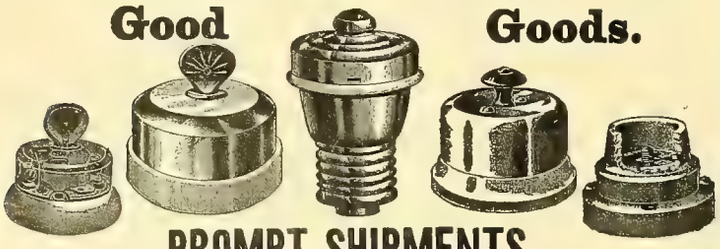

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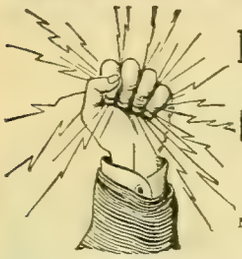

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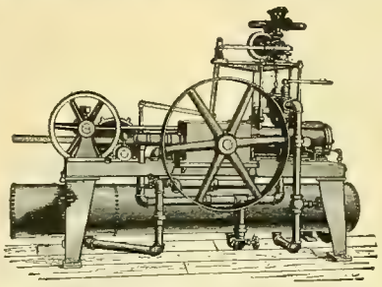

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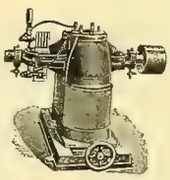

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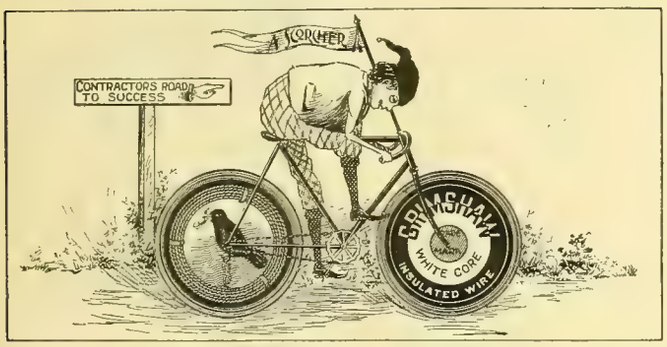


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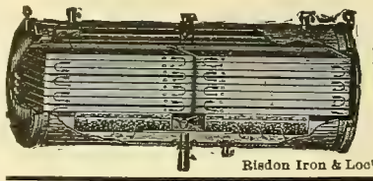

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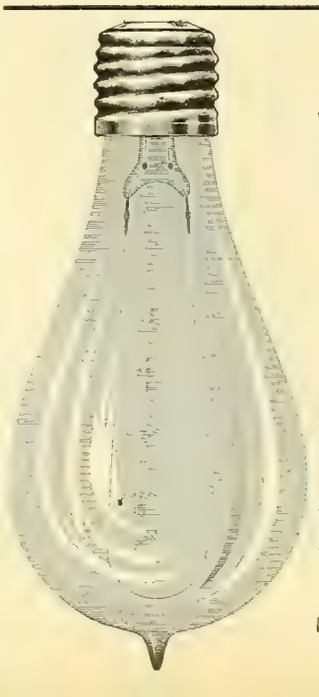

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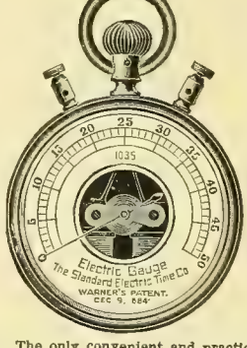


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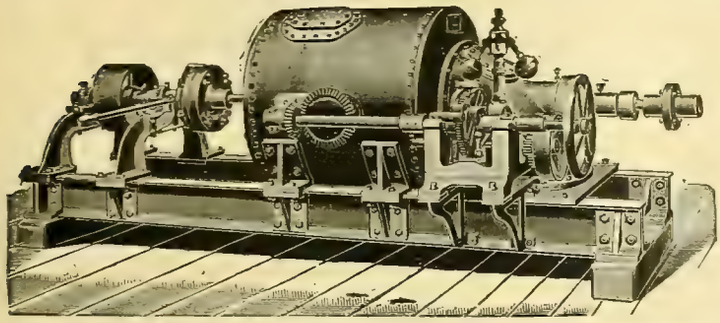

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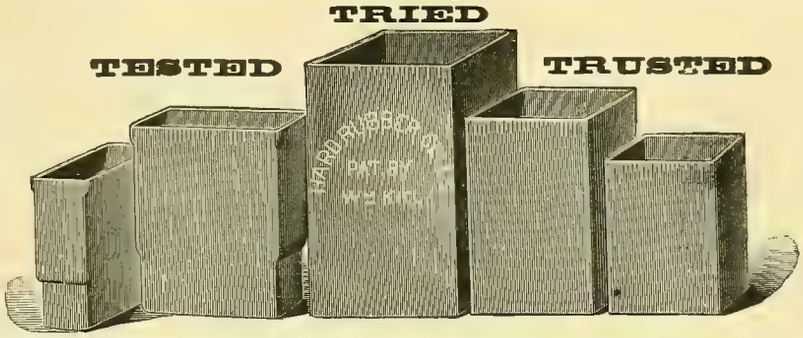


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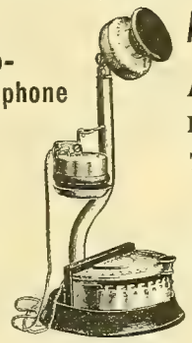

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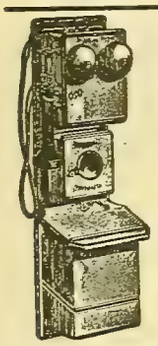

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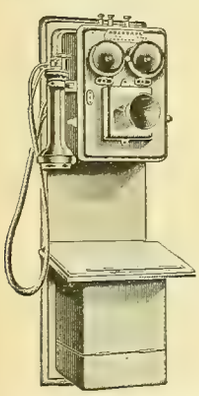

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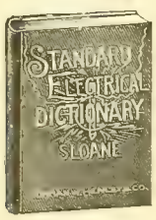

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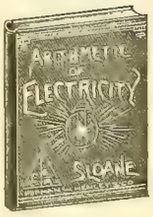

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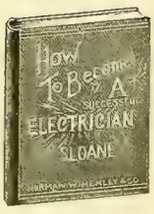

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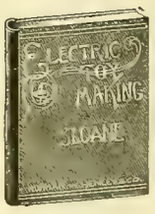

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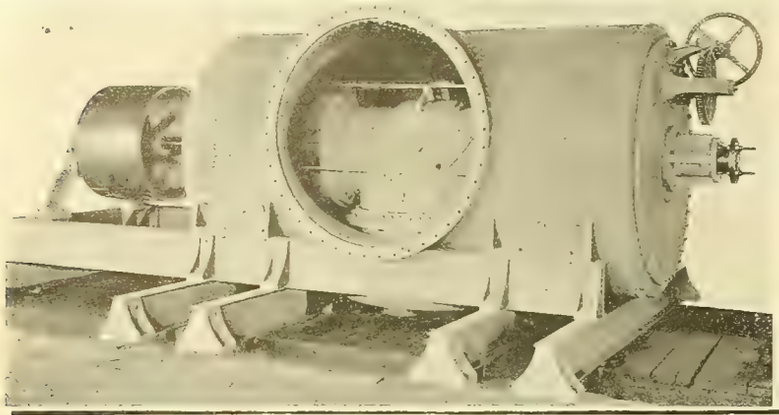

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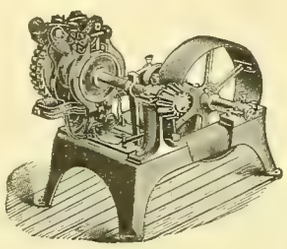

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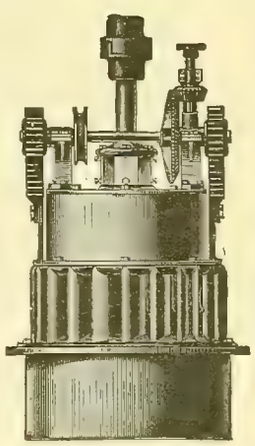

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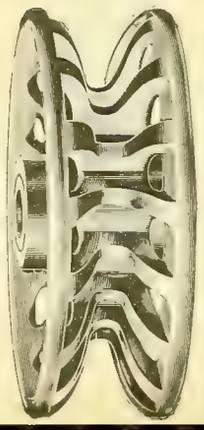

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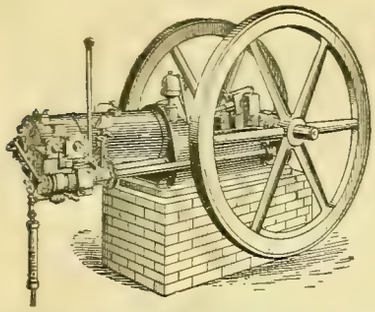

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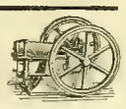

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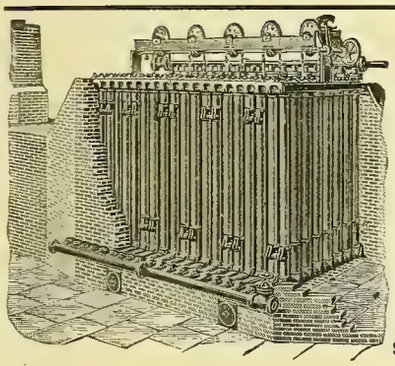

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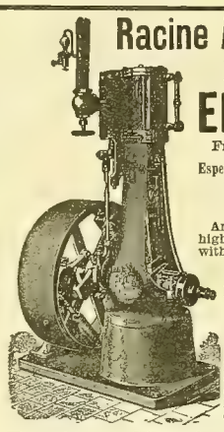

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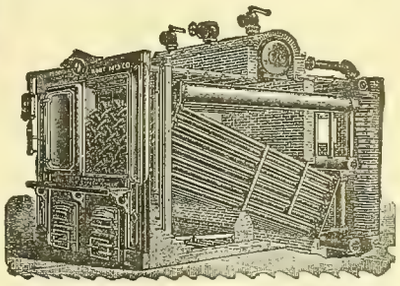

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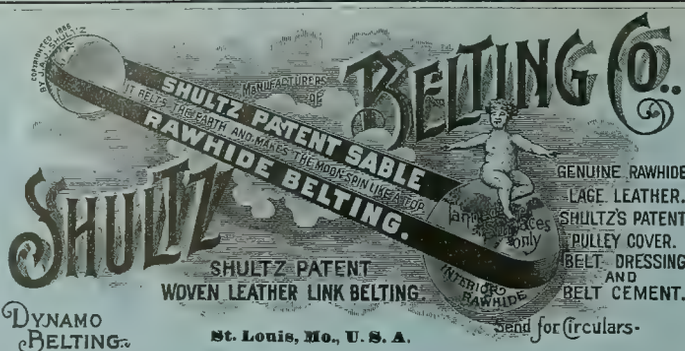


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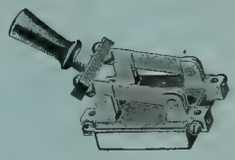

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